GeoJournal (2007) 70:91–107
DOI 10.1007/s10708-008-9132-1

Afghanistan's development and functionality: Renewing a collapsed state

John Shroder

Published online: 19 April 2008

Abstract Afghanistan has long been backward and underdeveloped where centuries of desertification, deforestation, overgrazing and environmental degradation have combined with successive invasions, violence, and terrorism to reduce the population to abject poverty. In the post 9/11 world, development of Afghanistan is seen as the only hope to revive the failed nation and reduce its threat to the external world. New assessments of natural resources offer many solutions to old problems of development and the potential economic functionality through renewal of the collapsed state. Oil, gas, copper, iron, gemstones, and a number of other resources, combined with a renewed transportation grid, offer a viable solution that is now underway to possibly produce a somewhat more promising future, providing that corruption, renewed violence, and environmental despoliation can be kept to a minimum.

Keywords Electricity · Environmental degradation · Hazards · Highways · Infrastructure Natural resources · Pipelines · Railroads

J. Shroder (✉)
Geography & Geology, University of Nebraska at Omaha, 60th & Dodge, Omaha, NE 68182, USA
e-mail: jshroder@mail.unomaha.edu

Introduction

Afghanistan was never a developed country or a place of enlightenment, but at least in the pre-war years of the 1960s and 1970s a number development projects there were reasonably successful in the Cold-War confrontation between the Soviets and the West (Dupree 1973; Rsanayagam 2003). The subsequent quarter century of conflict involved the well-known communist coup, Soviet invasion, Mujahideen counter-insurgency, Soviet defeat and withdrawal, civil war, repressive Taliban takeover, Al Qaeda terrorism, and a new invasion by the Western Coalition led by the USA (Bearden 2001; Bradsher 1983; Coll 2004; Crile 2003; Goodson 2001; Rashid 2001; Rubin 1995). In the immediate post 9/11 world great sympathy was given to the USA by many of the world's people who condemned the horrific attacks. Calls for the reconstruction and renewed robust development of Afghanistan to alleviate future problems have been equally strong (Jennings 2003; Shroder 2003, 2004), but the results have been rather lackluster and the Taliban and their al-Qaeda allies have reemerged as an increasingly potent force (Anonymous 2004; Danner 2005; United Nations 2006; Walsh 2006; Rohde and Sanger 2007). By late 2007 new reports on ongoing and emerging problems from authoritative sources (Moreau et al. 2006; Patel and Ross 2007; Bergen 2007a,b) indicated that Afghanistan was at a new tipping point; such that if more progress was not made soon, the future of any

reconstitution of the failed state was seen as potentially unlikely. This paper is a review of some of these problems and possible solutions.

During the Soviet–Afghanistan War in the 1980s, a number of papers were published on the role of natural resources in the conflict (Shroder 1980a,b, 1981, 1982, 1983, 1987; 1989a; Shroder and Assifi 1987). With the departure of the defeated Soviets in 1988–89, the use of the relatively rich natural resource base in the rebuilding of war-torn Afghanistan became more focused (Shroder and Watrel 1992). In a major study for USAID the Nathan–Berger (Nathan Associates & Louis Berger International, Inc. Afghanistan mineral resources study, Nathan Associates Inc., unpublished report for USAID, 1991) report emphasized three main strategic approaches to the development of the resource sector in Afghanistan:

- A 'national' or inward-oriented strategy for domestic needs.
- A 'regional' strategy for nearby countries.
- An 'international' strategy to serve world markets.

The regional and international strategies required a pipeline and possibly a railroad, noting especially that the international strategy was potentially the most encompassing and included the major targets of coal, natural gas, iron ore, copper ore, other ores, and gemstones that had the potential of producing considerable financial gain for rebuilding the country. Instead however, Afghanistan was abandoned by the USA and left to the Taliban and al Qaeda so that no further development occurred and the 9/11 conspiracy had freedom to grow to malignant fruition. Following the invasion of Afghanistan by the coalition forces in 2001, renewed interest in the role of natural resources in rebuilding the country reemerged (Shroder 2003, 2004).

Initial problems with reconstruction and redevelopment

At the outset after the successful invasion of Afghanistan, early recognition came that reconstruction and redevelopment of the country were essential to keep Taliban and al Qaeda from remerging (Ignatieff 2002). Afghans are quite pragmatic, so they were expected to wait and see what the invaders would do that might be of benefit to them; if it was to be insufficient, then al Qaeda would win another victory as big as 9/11 (Shroder 2002a,b). It was also noted that the military invasion of Afghanistan was relatively easy, with plenty of money available to accomplish the task. On the other hand, research efforts required to initiate redevelopment of the country was far more difficult and without significant funding. The War on Terrorism in Afghanistan was viewed as not over, it hadn't started substantively. The warlords and Taliban hadn't evaporated; just bided their time as the invaders settled in. Success in the War on Terrorism in that part of the world clearly would require vigilance, patience, study, and money. In early summer of 2002 the portents did not appear optimistic, especially because President Bush had already famously discounted nation building as a viable option, when it was patently obvious that nation building would be required for Afghanistan to rise from its ashes. "Nation building lite," the idea that empires come heavy, or not at all, as the Bush administration tried to reconstruct Afghanistan on the cheap (Ignatieff 2002), led to the prospect of potential failure early on, and the news has only been getting worse since (Shroder 2003; Fallows 2004; Danner 2005; Chayes 2006; Scheuer 2006; Rubin 2007; Bergen 2007a,b), as incompetent mistake is piled upon disastrous error (Bergen 2007c).

Even the best intentions of competent military advisors (Millen 2005) to legitimize the central government in the eyes of the Afghan people, develop positive media campaigns, stop opium production, and invest heavily in the military-based, provincial reconstruction teams (PRTs), were leavened by advice to remain cognizant of the ever-present Afghan propensity for xenophobia, regionalism and conflict. Furthermore, the concomitant predilection for graft and corruption at almost all levels in Afghanistan were also viewed as potentially overwhelming problems that would adversely impact development of the country (Delesgues and Torabi 2007).

New and promising natural resource development potentials

But lest anyone give up on Afghanistan too soon, there have been faint signs of progress in some quarters (Shroder 2004). In spite of alarmingly inadequate funding (only ~$5 million given out of some $70 million requested originally), the U.S.

Geological Survey (USGS), in collaboration with the British Geological Survey (BGS) and the revived Afghanistan Geological Survey (AGS), was tasked with a host of new assessments of oil, gas, coal, minerals, water resources, and seismic hazards, as well as geospatial infrastructure development and institutional capacity building. The original pre-war geological and mineral resource maps and reports on Afghanistan were updated and made freely available (Orris and Bliss 2002; Doebrich and Wahl 2006; Peters 2007), unlike the semi-secret nature of much of this work in the hands of the several hundred Soviet geologists who worked on it during the Cold War (Shroder 1980a,b, 1981, 1982, 1987, 1989a; Shroder and Assifi 1987; Shroder and Watrel 1992).

No one would have been surprised if not much had come of this new resource assessment. But by March 2006, geology took center stage in the northern reaches of Afghanistan where risk, reward and the potential creation of a new market place all hung in the balance as the USGS identified undiscovered oil reserves 18 times the amount originally thought to be possible and three times the natural gas prospects (Anonymous 2006a; Klett et al. 2006; Wandry et al. 2006; Blake 2006) (Fig. 1). Furthermore, the privatization of the Jawzjan (Province) Field (Fig. 2) was announced, which incentive could auger well for future 'wildcat' hydrocarbon discoveries, providing that the endemic corruption is not allowed to flourish alongside as well. To the prognosticators of the oil patch, this could be auspicious for industrial growth

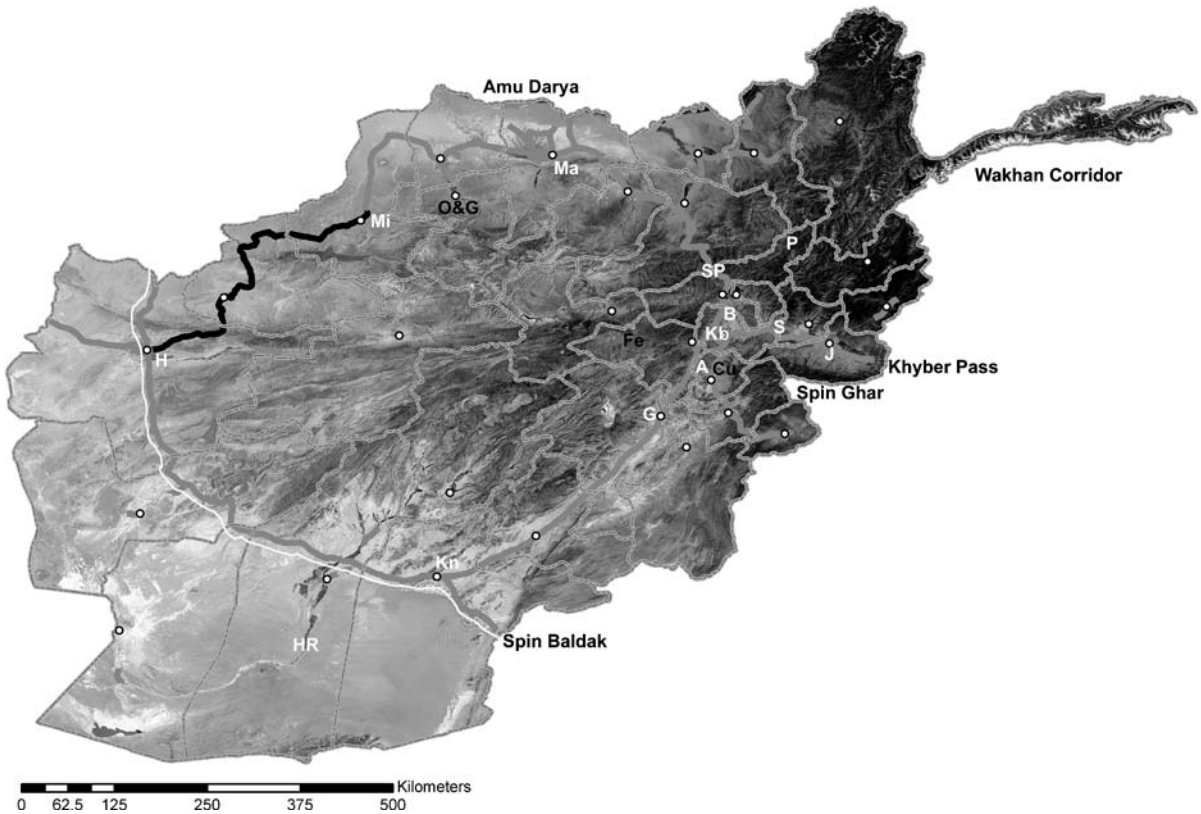

Fig. 1 Natural-color image mosaic of Afghanistan from Landsat Enhanced Thematic Mapper Plus (ETM+) data (after Davis and Hare 2007). Main paved highways in gray. The highway in black is the incomplete ring road, now little more than a rough track through the loess hills of the northwest. The proposed natural gas pipeline from Turkmenistan in Central Asia, across western Afghanistan through Spin Baldak to Pakistan is in thin white. Major resource deposits of copper (Cu) are at Aynak (A), iron (Fe) at Haji Gak, and oil and gas (O & G) in the northwest. B—Bagram; G—Ghazni; H—Hirat (Herat); Kb—Kabul; Kn—Kandahar; J—Jalalabad; Ma—Mazar-i-Sharif; Mi—Mimana; P—Panshir Valley; S—Surobi; SP—Salang Pass

Fig. 2 Location map of Afghanistan showing provinces (from Afghanistan Information Management Service—AIMS, in Kabul)

in Afghanistan, providing multinational oil companies or other nearby governments could be enticed into a drilling and production program. The governments of Pakistan, India and China were all reported to be interested, and in negotiations. Of course for any real production to begin, sufficient security must be guaranteed so that real success would be reasonably certain.

In another resource arena, only thirty km south of Kabul the world-class Aynak copper deposit (Fig. 1) has been assessed (BGS n.d; Anonymous 2006b) with various preliminary but laudatory reports of a minimum of at least 240 Mt of 2.3% grade ore, which is a high figure. The USGS (Peters et al. 2007) estimated the Aynak deposit to have a greater tonnage of lower grade ore, but even so, some 11,330,000 metric tons of Cu were thought to be recoverable. With the world-market price of copper currently so high, the potential for development of the Aynak deposit is thought to be robust. In November, 2006, nine companies from Australia, Canada, USA, India, Kazakhstan, Russia and China submitted tender offers; the state-owned China Metallurgical Group was awarded the contract in November 2007 (Anonymous 2007). Some $2.9 billion was pledged to Afghanistan to create a mine within 5 years. Environmental and socio-economic concerns that were raised in connection with China's mining projects elsewhere add to concerns, which may also include problems with corruption (Dalton 2007) that are reportedly endemic in the Afghanistan government bureaucracies.

In addition to these pronounced successes, assessing the coal resources has shown that Afghanistan has moderate to potentially abundant supplies, but the coal is relatively deep or currently inaccessible so that further development work and access improvement will be required (Anonymous 2005a). Most of the supplies are in the more northern regions of the country, but new areas of potential are also possible in the southeast in the unruly Pushtun heartland where production of coal-bed methane gas is also possible.

Finally after many years, with new access to all the classic Soviet era geology reports, the USGS with the AGS produced a major series of detailed geology and resource maps and reports in English, which can greatly accelerate a host of new resource-development projects. This enabled Peters et al. (2007) to produce a thick compendium assessment of non-fuel mineral resources in Afghanistan. As has long been suspected (Shroder 1982, 1983, 1987; Shroder and Asifi 1987; Shroder and Watrel 1992) the list of potential revenue-producing deposits is quite good, as befits its patch-work collage of crustal fragments that have accreted to the edge of the Asia Plate for several hundred million years. The preliminary assessments have resulted in identification of 20 promising mineralized deposits where future development of

the resources is most likely to occur (Table 1). So most strikingly, after all the predictions of a good resource base made over the past quarter century, at last we may presume that if security can be maintained and corruption suppressed, these resources, and others as yet undiscovered but predicted by Peters et al. (2007), could lead to very good things for Afghanistan's future economy.

Afghanistan Mines and Minerals Minister, Mohammed Ibrahim Adil has also announced in fall 2006 that contracts had been agreed upon in the private sector for the Ghori cement factory, the Karkar-e-Dodkash coal mine in Baghlan, the Jabal-suraj cement factory in Parwan, a flourite mine in Uruzgan, a gold mine in Herat, and a precious-stones mine in Nuristan. He added that other mines would also be offered to the private sector (BAAG 2006a). This is all very good news to the resource-development community because always in the past, all such natural resources from the ground were regarded as the property of the State and could not be extracted by individuals, or sold, or exported. Of course they were anyway, and smuggling and corruption were rife as a direct result. In this new fashion of privatization, the new incentives, if coupled with good and fair tax controls, the results could be quite beneficial to the economy.

In other reasonably optimistic scenarios, the Asian Development Bank (2007) and the World Bank (2005, 2007) have developed various plans to improve the economy. The Asian Development Bank (2007) noted especially that the government of Afghanistan (GOA) had identified four priority sources of growth: (1) agriculture (fruit, livestock, agro-processing, rural industries); (2) mining and extractive industries; (3) sale of public land for housing and privatization of state enterprises; and (4) transit trade in goods and energy. Its strategy for the country and its program updates for 2004–2006 were comprehensive yet seemingly quite reasonable (Table 2). The World Bank strategy focuses on: (1) building capacity and accountability of the state to ensure the provision of affordable, accessible and adequate services; (2) improving rural livelihoods and promoting rural economy; and (3) supporting the growth of a formal, modern, and competitive private sector. A detailed breakdown of problems, possibilities, and recommendations has been provided for the financial sector (Table 3) by the World Bank (2005). At 162nd place, Afghanistan does, however, rank lowest in South Asia in ease of doing business there, so the optimistic scenarios may ultimately have to be more tempered by reality (World Bank 2007).

Post-conflict environmental assessment

Effective natural resource management and rehabilitation have to become a national priority if Afghanistan is ever to achieve long-term social stability, much less actual prosperity (UNEP 2003). Unfortunately and tragically, the combined forces of warfare, civil disorder, lack of effective governance, and long, strong drought have taken a major toll on Afghanistan's natural and human resources. Long-term general degradation of the landscape has been almost everywhere in the country apparent for centuries since Emperor Babur's descriptions of 500 years ago (Shroder 1977; UNCOD 1978). Because of this decline of the natural resource base, the country's vulnerability to natural disasters and food shortages has increased, which adds to the already uncertain future. UNEP's (2003) post-conflict environmental assessment in Afghanistan has included such vital environmental issues as waste, sanitation, and pollution "hotspots" in urban areas, air quality, deforestation, desertification, and surface and ground water resources.

Waste and sanitation in Afghanistan are famously problematic; management of liquid and solid waste is one of Afghanistan's most serious environmental problems, and the direct implications for human health are obvious. UNEP (2003) has noted that the GOA must develop a national strategy for waste management and initiatives for the entire waste cycle from consumer behavior to final proper disposal. Rampant medical waste scattered around on the ground, little to no waste water treatment, open sewer ditches, total lack of underground sewers or septic tanks, unregulated use of chemicals and hazardous wastes, war-related chemical damage, unexploded ordinance; all these factors and many more add to the environmental degradation, shorten life spans, add to the child mortality rate that is already among the world's highest, and further reduce the ability of the people to cope with an already difficult situation. Air quality is similarly problematic in Afghanistan, especially in urban areas. UNEP's (2003) recommendations

Table 1 Preliminary non-fuel resources assessment of Afghanistan (after Peters et al. 2007)

Metals

Copper (Cu)—World-class Aynak, & Darband, Jawkhar, Taghar—Cu is ~12.3 MMT.

Additional predicted in Kabul & Logar Basins ~ 16.9 MMT Cu, 7,670 MT silver (Ag), & 601,500 MT cobalt (Co).

Estimated in Herat, Kandahar, & Zabul Provinces ~68,500 MT Cu with auxiliary gold (Au), lead (Pb), & zinc (Zn).

General porphyry copper deposit model in 12 areas, estimates 8 undiscovered porphyry copper deposits containing mean of 28.5 MMT copper, 724,010 MT molybdenum (Mo), 682 MT Au, and 9,067 MT Ag.

Iron (Fe)—World class Haji Gak iron deposit (~2 BMT at 63 to 69 weight (wt.) % Fe) sufficient to support major mining. Additional deposits totaling 2.26 MMT Fe with greater than 62 wt. %t Fe.

Furmorah skarn deposit 35 MMT at 47 to 68 wt. % Fe, sulphur (S), phosphorous (P), nickel (Ni), & manganese (Mn).

Gold (Au)—Hard rock lode, quartz vein, skarn, & alluvial placers in Badakshan & adjacent Provinces.

West Zabul, Western Ghazni Provinces have measured 1,780 kg of gold.

Takhar & Ghazni Province placers have measured 918 kg Au.

Gold occurrences could support local industry for small- to medium-scale mining.

Lead (Pb) and zinc (Zn) Nalbandon in Ghor Province and Spira in Paktia Province estimated to contain 153,900 MT Pb & Zn.

Darra-i-Nur and Kalai-Assad in Kandahar Province contain ~90,000 MT Pb & Zn.

Pb-Zn-Ba-(± Cu, Ag) deposits have potential for local mining.

Tin (Sn) and tungsten (W) abundant in Afghanistan & potentially important in west.

Mercury (Hg) deposits present along 400-km × 30-km area in southwest Afghanistan mean expected 32,000 MT of undiscovered Hg, enough to support local industry.

Two other areas in west central and east also contain anomalous mercury zones.

All areas containing Hg also likely have Ag & Au.

Bauxite aluminum (Al). Bauxite aluminum ore at Obato-Shela, Zabul Province and Nalag (Tala), Baghlan Province with 4.5 MMT bauxite ore grading 50.5 wt. % alumina and ~12 wt. % silica. Overall small size, high silica content, and need for plentiful electricity for refining make bauxite mining soon unlikely.

Industrial minerals

Asbestos in Loghar & Khost Provinces with chromite; estimates give mean of 13.4 MMT of undiscovered asbestos, perhaps sufficient to support local industry.

Barite ($BaSO_4$) occurs in central Afghanistan, mainly with spatial relation to Pb & Zn. Farenjal Barite deposit in Parvan Province contains 150 MMT of barite. Quantity probably sufficient for local industry and exploitation of oil and gas.

Borate ($HRBO_3$, where R= Mg, Mn, or Zn) may occur in some young evaporate deposits, and additional study of such environments recommended.

Celestite ($SrSO_4$) occurs in Baghlan and Kunduz Provinces with speculative resource of 1 MMT ore at about 75 vol. % celestite.

Chromite ($FeCr_2O_4$) in Logar and Khost Provinces, with calculated resources of ~200,000 MT at ~43 wt. % chromium oxide. Many small podiform chromite deposits. Estimated undiscovered resources expected additional 980,000 MT of chromium oxide. Total Cr resources might support small-scale industries.

Clays abundant & adequate for local construction. Known resources of kaolin occur in residual and sedimentary deposits mainly in Baghlan Province totaling ~535,000 MT. ~ 2.2 Mm^3 of brick clay present at Deh Kepak deposit in Kabul Province.

Fluorite (CaF2)—occurs in Bakhud, Uruzgan Province. Resources are 8.8 MMT of ore averaging 47 vol. % fluorite. Additional occurrences in the same region suggest potential for economic deposits sufficient for local consumption.

Gemstones. Originally a major industry as premier source of lapis lazuli; emeralds and rubies from northeast Afghanistan (Badakshan, Konar, & Nuristan Provinces), including emerald in Panjsher Valley, ruby, sapphire and spinel in Jegdalek, Balal (Ab-i-Panja), & lapis lazuli at Sar-i-Sang on the Kochka River in Badakhshan Province. Garnet, kunzite, ruby, and tourmaline gemstones present in many numerous pegmatites. Peridot along Afghanistan–Pakistan border. Many gemstone areas sufficient to support local industry & major export possible.

Graphite (C) in Archean metamorphic rocks in Badakhshan Province and south of Kabul as disseminated flake graphite. Deposits small (<5,000 MT), & additional deposits may be located with an expected mean value of 1 MMT. Disseminated flake graphite could be used locally in handling molten metals and as lubricants.

Gypsum ($CaSO_4.2H_20$) is abundant and widely dispersed. Local industries might develop around it, such as cement, wallboard, and soil enhancement.

Halite (NaCl) is enough salt to support local industry and current internal needs.

Table 1 continued

Pegmatites—measured resource of ~3.8 MMT of lithium oxide. Abundant pegmatite fields contain lithium, beryllium, quartz, feldspars, micas, gemstones, tantalum, niobium, and cesium. Could be used for local glass, chemical, or artisanal industries.
Potash (KCl)—important fertilizer, may be in evaporate deposits associated with petroleum resources in north. Mean expected value of undiscovered potash of 27.5 MMT.
Rare-earth elements (REE) and uranium (U) occur in carbonatite volcano at Khanneshin in Helmand. Quantitative estimation for undiscovered resources produced mean expected value of 1.4 MMT REE and 3.5 MMT Nb with additional P, U and Th.
Sulfur (S) occurs in Bakhud and Badakhshan Provinces at 450,000 MT. Significant bedded sulfur estimates undiscovered in Afghan-Tajik Basin give mean 6 MMT.
Talc and magnesite—small ultramafic deposits in Logar Valley & Khost Provinces; larger metamorphic source at Achin south of Jalalabad is largest in Afghanistan at 1.25 MMT talc and 31,200 MT magnesite.
Building materials
Building and dimension stone. Granite, marble, limestone, travertine (aragonite), & sandstone abundant. Major industry possible if economic & expertise problems overcome. Limestone suitable for cement in Badakshan, Baghlan, and Herat Provinces.
Sand and gravel. Abundant but unknown quality sand and gravel & rock for crushed stone and aggregate but accessibility problems due to isolation, urban locations, & lack of infrastructure but adequate for most local industry adjacent to most population centers.

MT, metric tons; MMT, million metric tons; BMT, billion metric tons; Mm^3, million cubic meters

(Table 4), if implemented, could do much to improve the quality of life for thousands of people.

Deforestation and desertification of Afghanistan have been progressing apace since Babur's descriptions, but nowhere is this fact more striking than in the past three decades of satellite imagery where direct quantitative comparison can be made. For example, UNEP's (2003) polytemporal image comparisons allowed a number of case studies (Table 5), with Nuristan, Kunar, and Nangarhar provinces in the east showing a 52% decrease in forests between 1977 and 2002. Nangarhar, the province in which both Jalalabad and the Spin Ghar (Safed Koh) Range are situated (Fig. 1), was the hardest hit, with a 71% decrease in forest cover. Takhar and Kunduz provinces in the northeast in 1977 had woodlands originally of 37–55%, respectively, but such trees were undetectable by 2002, which may indicate nearly complete deforestation. Badghis Province in the northwest has also lost most of its forests, originally in 1977 with ~9 % (tree cover >40%) and low density woodlands (20% < tree cover < 40%) down to 2002 that by then had <1% of any form of woodland left. By 2005 only 1.3% or about 867,000 hectares of Afghanistan was still forested (Anonymous 2000). In total, between 1990 and 2005, the country lost ~34% of its forest and woodland cover, a striking number that only adds further emphasis to the unhappy situation of unsustainable despoilation that will continue to bring adverse pressure on the government in Kabul. UNEP (2003) has made a series of recommendations (Table 6), which if implemented even partially, would do much to alleviate the problems with the deforestation.

Desertification is another serious problem that has been progressively increasing in Afghanistan for centuries (Shroder 1977), as widespread deforestation, over-grazing, and unmanaged water-well pumping take their environmental toll. UNEP (2003) has recommended immediate attention to the problem (Table 7).

Climate and water resources

Arid Afghanistan lives or dies on its future water resources; droughts and paralyzing dust storms have increased in magnitude and frequency in the past three decades (TSIA 2004). The future does not look auspicious. Satellite imagery over the past three decades dramatically documents the problem as lakes and rivers dry up entirely in some cases. For example, the Hamoun oasis, at the end of the Helmand River where it debouches into a series of lakes on the Afghanistan-Iran border (Fig. 1), has gone though a series of devastating droughts (Whitney 2006). The Helmand River ran dry in 2001 (Weier 2002). Satellite imagery of November 1976 and September 1997 shows full lakes, but in September 1987 all but one lake was gone, and in October 2001, no lakes were left (UNEP 2003). These lakes do have the

Table 2 Country strategy and program update for Afghanistan for 2004–2006 by Asian development bank (BAAG 2004)

- Support to agricultural development, including rehabilitation of irrigation.
- Rehabilitation of electric power infrastructure, with particular attention to repair of power transmission & distribution lines & substations.
- Support to gas production transmission & distribution.
- Rehabilitation of national roads, including Pul-e-Khumri—Mazar-i-Sharif—Shiberghan section of ring road, & connectors to Turkmenistan & Uzbekistan. Support to Kandahar—Spin Boldak road (to Pakistan). Feasibility study for Heart—Ankhoy road (the northwest part of the ring road).
- Rehabilitation of regional airports.
- Support to development of cellular telephone communication system.
- Support to governance process through public service delivery reform.
- Support to financial institutions, including the Afghanistan International Bank.
- Program support for financial market & private sector development.
- Provision of political-risk guarantees to potential investors.
- Support to edible oil processing venture in Mazar-i-Sharif.
- Support to programs aimed to improve air quality in Kabul.

capacity to recover if higher precipitation ever does return to the highland areas that provide the main river discharges in the region.

Water-resource assessment, monitoring, and capacity building to ensure safe, adequate, and sustainable water resources in Afghanistan has been a major part of the work of some assistance agencies, such as the UN (Table 8) and USGS (Banks 2002; Banks and Soldal 2002; UNEP 2003; USGS 2006). The recent droughts have dried up a large number of springs, underground karez, and wells used for irrigation and domestic supply. In addition, the indiscriminant and unplanned drilling of wells has exacerbated the problem and showed the necessity of developing guidelines for sustainable use of the groundwater (Banks 2002; Banks and Soldal 2002). In the face of these problems the USGS has implemented a basic monitoring infrastructure and strategy to assess, understand, and manage the water resources of Afghanistan. Ironically this has to be done for a second time by the USGS after the past two decades of war and the loss of most of the original records and record-keeping capacities that they had produced for Afghanistan originally (Heckmiller 1961; Westfall 1969). An important new report in this process has been an inventory of ground-water resources in the Kabul Basin (Broshears et al. 2005). Other USGS successes have included detailed studies of the hydrology of the Helmand Basin (Whitney 2006), and satellite image analysis of data and information on snow cover, ice and glaciers that become meltwater downstream.

Some of this work by the USGS has benefited from that begun by (Shroder 1980c, 1989b) and re-energized in the late 1990's by NASA and USGS grants to the GLIMS (Global Land Ice Measurements from Space) Project, in which UNO has become the GLIMS Southwest Asia (Afghanistan & Pakistan) Regional Center (Shroder et al. 2005). Terrabytes of ASTER satellite imagery and other sources have enabled a series of papers dealing with glaciers of the region. This has helped define the loss of ice resources over the past four decades of increasing drought (Shroder and Bishop 2004, 2008; Shroder et al. 2005).

Required infrastructure improvements

The infrastructure of Afghanistan has always been exceptionally poor, and two decades of war have helped destroy much of what was left. The US Agency for International Development (USAID 2005), and the nations of the North Atlantic Treaty Organization (NATO), have been undertaking the dominant development work (Table 9). Roads, dams, power lines, buildings; the list is long and only a few topics are touched on here of particular relevance to exploiting the natural resources.

Table 3 Executive summary of investment climate in Afghanistan (after World Bank 2005)

A. Recent reforms & progress.

1. Afghanistan moving toward politically and economically viable state.
2. Economic growth dramatic during recent recovery.
3. A stable macroeconomic environment is established and steps taken to foster trade.
4. Despite rapid economic growth one of world's poorest countries is little changed.
5. International assistance funds majority of GOA expenses and almost all development.
6. Government is fostering private sector investment.

B. State of private sector.

1. Long years of conflict destroyed most production capacity and forced flight of many skilled workers and managers.
2. Private investment is limited compared to potential.
3. Overseas Afghans are a potential funding source.
4. Existing firms are performing on par with firms in neighboring Central Asia.
5. Industry's recovery evidenced by investment activity
6. Industry starts from a low base & most investment is in basic production processes.

C. Today's Investment Challenges: Investment Climate Constraints.

Overall

1. Government has improved business environment with tax reform.
2. Perceived obstacles are electricity, land access, corruption, & finances.

Security

3. Crime & disorder not ranked as high because accommodations have been made.
4. New investors with no connections to powerful figures find environment daunting.

Infrastructure

5. Infrastructure among world's worst, even below that of Sub-Saharan Africa.
6. Power is poor and unreliable.
7. War-ravaged transportation network is top priority for repair.
8. Telecommunications are developing rapidly.

Access to factors of production: land, labor, and capitol

9. Land access is serious problem.
10. Skill level is woefully low.
11. Access to finance is highly problematic.
12. Informal *hawala* financial sources play most important finance role.

Governance: legal framework, judicial & regulatory enforcement, & government functioning

13. The legal framework is weak.
14. Judicial & regulatory enforcement is almost nonexistent.
15. Business registration, tax administration, & labor law are not significant obstacles.
16. Government policies & actions have been predictable.
17. Corruption is endemic.
18. Government institutions are weak.

Trade policy & trade facilitation.

19. Trade policy one of most open in region.
20. Customs administration is arbitrary & corrupt.
21. Trade facilitation services are weak or nonexistent.
22. 38 % of exporters noted transport & customs as main problem.

Dominance of informal arrangements—a vicious circle?

23. Most private sector activity is informal.
24. Informal is useful in short run but negative for overall growth.

Table 3 continued

D. Accelerating private investment: what needs to be done?
25. Remove barriers to new entries.
26. Reduce uncertainty & transactions costs; improve access to inputs, business services & markets.
27. Privatization transactions need initiation, implementation & transparency.
28. Infrastructure services need massive investment, reforms in policies, regulations, & institutions, including operation & maintenance.
29. Broadening & deepening access to finance is required.
30. A sound legal, judicial, & regulatory framework is needed to clarify property rights to enable investment.
31. Improved information flow is required.
32. A fundamental underlying need exists to improve government capacity to assess private sector issues & formulate & implement private sector development policies & programs.

Table 4 Air-quality improvement recommendations in Afghanistan (after UNEP 2003)

1. Protect workers.
2. Improve public transport systems.
3. Use cleaner fuels.
4. Increase the use of natural gas.
5. Regularly inspect the transport sector.
6. Institute a central system of heating.
7. Stop uncontrolled burning of wastes.
8. Manage industrial air pollution.

Table 5 Forest decline in a real percent in selected provinces of Afghanistan, based upon maps made from satellite imagery from 1976–77 and 2002 (UNEP 2003)

Province	1976–77 (%)	2002 (%)
Badghis	9	<1
Kunar	73	37
Kunduz	2	0
Nangahar	27	3
Nuristan	60	14
Takhar	16	<1

Natural hazards

In addition to the hydrocarbon, mineral-resource, and hydrological assessments that the USGS accomplished over the past five years, it has also played a major part in providing a foundation for assessment of earthquake hazards that so bedevil any significant construction in the country. Reconstruction of the country's infrastructure and development of its natural resources are ever jeopardized by the omnipresent threat of the strong ground shaking, surface rupture, liquifaction, and extensive landsliding that strong, damaging earthquakes can produce (Anonymous 2005b; Wheeler et al. 2005). The USGS seismic-hazard assessment involved: (1) compilation of historical and instrumental records and maps; (2) seismotectonic maps; (3) study of earthquake source zones and production of Quaternary fault maps from satellite imagery (Ruleman et al. 2007); (4) training of Afghan scientists and technicians; (5) establishment of regional seismographs; and (6) development of a regional seismic hazard map. Landslide hazards that occur all across the region had been studied by Shroder (1989c).

Electric power

Most people in Afghanistan did not have electricity in the twentieth century, and in the 21st only some 6–7 percent receive a little power, intermittently for ~4 h/day, and 30 percent of all the citizens who use that power are in Kabul. More than two decades of armed conflict have largely destroyed the electric infrastructure, which dramatically reduced consumption, of course. Fraser et al. (2003), writing for the GOA, have noted that there are some 42 electric plants in Afghanistan (~19 hydroelectric, ~17 diesel, & miscellaneous other), most dating from before the war, but the 'nameplate' electric capacity of 454 MW was not the actual production in 2003 of 240 W, due to war damage and lack of maintenance. Because of the lack of a national grid, Strock (2006) has suggested production of 'pinpoint' electric-source plants (micro-hydroelectric power—.5–150 KW) planned for rural areas. In fall 2006, agreements were signed for import of electricity from the three

Table 6 Forestry management recommendations (after UNEP 2003)

1. Undertake immediate soil stabilization measures.
2. Begin community-based reforestation.
3. Reinstate community-based forest warden system.
4. Allocate woodlands to communities.
5. Employ grazing management and rotation systems.
6. Establish community-based woodlots.
7. Establish woodland management legislation.
8. Establish seed banks.
9. Establish woodland protected areas.
10. Develop alternative incomes (managed orchards & medicinal plant nurseries).
11. Rebuild community control and government influence.
12. Improve transboundary cooperation to stop timber smuggling.
13. Introduce a timber cooperative.
14. Seek 'win-win' outcomes in the use of 'Green Forces' by GOA to control forests and local communities to exploit the resource.
15. Control road access to forests.
16. Estimate future demands.
17. Establish forest-management legislation.
18. Undertake gradual implementation of export controls on timber harvesting.
19. Institute grazing management and rotation systems.
20. Develop demonstration sites showing the viability and benefits of forest conservation.
21. Promote strict protection of forest sites as part of national protected-areas system.

Table 7 Recommendations concerning desertification (after UNEP 2003)

1. Stabilize sand dunes and soils.
2. Reseed highly degraded rangeland.
3. Reduce grazing and dryland cultivation in vulnerable areas.
4. Map areas vulnerable to desertification.
5. Create community-based rangeland assessment and management plans.
6. Establish representative rangeland areas where grazing is excluded or experimentally controlled.

Central Asian Republics of Tajikistan, Kyrgystan, and Uzbekistan, into Afghanistan and to Kabul, as well as on to Pakistan (BAAG 2006). Detailed plans and forecasts of future national electric use have been drawn up, presumably on the assumption that funding will become available, and that further hostilities will

Table 8 Water supply recommendations (after UNEP 2003)

1. Identify and eliminate cross contamination.
2. Stop unmanaged deep well drilling.
3. Protect water-supply sources.
4. Properly equip the water sector.
5. Promote water conservation.
6. Develop national water resources management strategy.
7. Develop national water authority.
8. Promote transboundary water-resources management.
9. Study hydrological contributions of glaciers, permanent snowfields and snow fall.
10. Consider impacts of climate change.

be minimal (Fraser et al. 2003). Certainly because of its location as the head of three major drainage basins (Indus [Kabul], Turkestan Endorheic [Amu Darya], Iran-Sistan [Helmand]) (Shroder 1980c), and the Hindu Kush mountains of Afghanistan provide plentiful locations for the development of hydroelectric power plants, and with minimal environmental damage because of the limited biota in the harsh landscape.

Highways

Another major factor in the redevelopment of Afghanistan is, of course, the re-establishment of an efficient highway system that existed (except from Mazar-i-Sharif to Herat) twenty years ago before the wars (Fig. 1). These were mostly built by Soviet and American highway engineers in the 1960s, particularly the ring road from Kabul, Ghazni, Kandahar, Herat, Maimana, Mazar-i-Sharif, Salang Pass, and back to Kabul; from Kabul to Jalalabad and the Khyber Pass to Peshawar Pakistan; as well as from Kandahar to Chaman and Quetta, Pakistan; from the west out into Iran; and from the north into Uzbekistan, and Turkmenistan (Dachiku and Tahir 2002).

The primary highway network was ~4,499 km long, but about half of it in 2002 was in exceptionally poor condition (good, 14%; fair, 24%; poor 15%; very poor 47%) and the rehabilitation cost at that time was estimated to be about ~$1677.22 million. Secondary and tertiary roads connecting provincial centers are a point of focus, as well as village area roads (Strock 2006; Nelson 2007; USAID 2007). The Afghanistan Information Management Service (AIMS) keeps track of myriad changes in the country

Table 9 North Atlantic Treaty Organization (NATO) progress in Afghanistan in 2007 (after NATO 2007)

Reconstruction and development

$26.8 billion has come to Afghanistan since 2001, including $10.5 billion pledged at the London Conference in 2006.

Health

- 83% of population now has access to medical facilities, compared to 9% in 2004.
- 76% of children <5 years have been immunized against childhood diseases.
- >4,000 medical facilities opened since 2004.
- >600 midwives trained and deployed in every province.

Economy

- GDP growth estimates of 12-14% for the current year.
- Government revenues increased ~25% from 2005/06 to 2006/07.
- Per capita income at $355, compared to $180 three years ago.
- Afghanistan one of the fastest growing economies in South-East Asia.

Private sector

- 10% of Afghans own mobile phones, compared to 2 lines per 1000 people in 2001.
- 150 cities across Afghanistan now have access to mobile phone networks and internet provider services.
- Multinationals and internationals operating or showing an interest in Afghanistan include Coca Cola, Siemens, Nestle and Etisalat.
- Evidence of strong consumer demand in Kabul (e.g., road traffic, new shopping malls, new hotels).

Infrastructure

- Over 4,000 km of roads completed.
- Work has begun on 20,000 new homes for Afghans returning to Kabul.
- Over 1 billion m^2 of mine contaminated land cleared.
- 17,000 communities benefited from development programs such as wells, schools, hospitals and roads through the National Solidarity Program (NSP).

Security

- Over 60,000 ex combatants disarmed and reintegrated.
- 35–40,000 officers are serving in the new national police force.
- 30,000 soldiers are serving in the new national army.

Refugees

- 4.8 M have returned so far (3.5 M with the UN's help).
- UN refugee agency has helped provide >1 million shelters for returning refugees.

Women

- Over a quarter of parliamentarians are women.
- Millions of girls in school with 400,000 new females starting school for first time.
- Over 100,000 women benefited from micro-finance loans to set up own business.

Schools

- Over 7 million girls and boys are in school or higher education.
- 10 universities, against one (barely functioning) under the Taliban.

Media

- 7 national TV stations (6 private); numerous radio networks, plus diverse and increasingly robust and professional print media.

Current status Of PRT projects—Source: ISAF

Regional Command (C) Capitol Kabul—Italy, France, Bulgaria

- Since 2002, 746 CIMIC projects totaling $15.4 M; and 1,565 other major infrastructure projects totaling $1.5 M.
- Since August 2006, RC(C) has built veterinary hospital, sports field, water reservoir, & three wells.
- Several schools repaired & 6 new schools.
- One bridge & two foot bridges.

Table 9 continued

- Since August 2006, 14,000 Afghans have received medical assistance, ranging from the distribution of simple medication to the most sophisticated procedures.

Regional Command (*E*) *Bagram—USA*

- Since 2002, 1,376 PRT projects totaling $504.8 M, and 14,388 other major infrastructure projects totaling $2.7 M.
- Since October 2006, 200 km of roads were built.
- Thanks to school repair and construction work, 35,000 students accommodated during various school shifts.

Regional Command (*N*) *North*—Germany

- Since 2002, 1,054 PRT projects totaling $31.5 M, and 6842 other major infrastructure projects totaling $2.2 M.
- 185 ongoing R&D projects totaling $6.5 M in 2007. R&D for 2007 is $21.3 M.

Regional Command (*S*) *South*—United Kingdom

- Since 2002, 1,362 PRT projects totaling $175.3 M, and 4,150 other major infrastructure projects totaling $1.8 M.
- Repair of Kajaki Dam in Helmand aimed at providing power to 1.7 million people, irrigation to farmers, jobs to thousands within the next 2–3 years.
- The major Gerishk–Sangin–Kajaki road-building project started and progressing north.
- ANA patrol bases and 18 new permanent security check points being constructed.

Regional Command (*W*) *West—Italy*, *Spain*

- Since 2002, 1,369 PRT projects totaling $160.7 M, and 3,218 other major infrastructure projects totaling $2.7 M
- In 2006, $64 M were invested in reconstruction and development and $216 M spent on the construction of the Herat-Farah ring road.
- In 2007, R&D budget for PRTs amounts to $42 M.

ISAF, International Security Assistance Force; PRT, Provincial reconstruction teams; M, million

and has produced a continuously updated series of road reconstruction status maps (among a host of other projects noted below) that show areas that are being studied, planned, financed and under construction. The many agencies involved in financing, and in road reconstruction at the present time include the EU, World Bank, USAID, the Iranian Government, Asian Development Bank, Aga Khan Development Network, Mercy Corps, Partners in Revitalization and Building, Shelter for Life, and other agencies. Much remains to be done but it is clear that a good start is underway.

In addition, the signing of the contract with the government of China to mine the Aynak copper ore may also lead to eventual road construction from China through the Wakhan Corridor and the Panshir Valley to Kabul. Chinese engineers and workers have plentiful past experience with such high-altitude, mountainous endeavors, inasmuch as their great skill at such work enabled construction of the paved Karakoram Highway (KKH) through northern Pakistan in the 1970s (Ispahani 1989). A similar road-building effort into the Wakhan from the nearby KKH in southwestern China would be relatively simple and would lead to accelerated truck trade between the two countries by bypassing the existing Pakistani choke points.

Pipelines

Afghanistan is located between the oil and natural gas reserves of the Caspian Basin of Turkmenistan and the Indian Ocean so the country has been considered as a possible energy transit route for many decades, with a recent proposal being that of Unocal's during the Taliban years that was cancelled in 1998 when the US fired cruise missiles into bin Laden's al-Qaeda terrorist training camps. Most recently in 2002 the Asian Development Bank has studied the proposed 1,460-km Trans-Afghanistan Pipeline (or TAP) that would tap into >2.83 trillion m^3 of natural gas reserves at Turkmenistan's huge Dauletabad–Donmez field and deliver it across Afghanistan to both Pakistan and, perhaps, India (Fig. 1). The pipeline would carry up to 20 billion m^3 of gas a year, which would generate $100–300 million per year in transit fees for Afghanistan and create thousands of jobs. The project was to start in 2006, but the cost of the pipeline would be ~$3.5 billion, and this cost and the uncertain security in the country has precluded its

construction up to now. In addition, President Niyazov of the Russian gas company, Gazprom, in Turkmenistan has expressed doubt about the project, the price has not been established, a consortium to handle the project had not yet been created, and priority could be given to Russia instead of Afghanistan (BAAG 2006).

The Soviet Union had constructed several pipelines in Afghanistan, the first in 1967 to exploit the natural gas of Shibarghan and send it north across the Amu Darya River into the pipelines of Turkmenistan (Shroder 1983), and later during the Soviet–Afghanistan War, the Soviets constructed a small diameter pipeline south to the Bagram military base to provide fuel for their troops. These pipelines are, however, known to have been in disrepair and disuse for a number of years.

Railroads

New concepts about establishment of a first real railroad system into Afghanistan have remerged recently. These ideas were much discussed in the nineteenth and early twentieth centuries (Baker 1917), but Amir Abdur Rahman Khan, ruler of Afghanistan from 1880 to 1901, always thought that a railway would be used for invasion. So as long as he was in power he resisted such construction, referring to the British railroad line to the south border near Chaman as "a knife pushed into my vitals." From 1923 to 1929, however, was the only time that Afghanistan ever had an actual railway, and that was only 7 km from central Kabul City southwest to Darulaman Palace as a showpiece under the brief reign of the enlightened and western-oriented King Amanullah (Grantham 2006). Otherwise only a few short connectors ever came barely over the border from the surrounding countries seeking to facilitate more efficient transport.

A variety of different routes have been looked at over the years, including an old secret British survey from Torkam at the Afghanistan (northeast) side of the Khyber Pass through Jalalabad, up to Surobi, and then up the Panjshir River valley and across it on a high bridge to Bagram and then back south to Kabul (N. Allan, email correspondence, 11/27/2006). Most prior plans bring such a railway in from the south through Quetta and Chaman in Pakistan, over the Afghanistan border at Spin Baldak, and thence to Kabul in the northeast, as well as Kanadahar and Herat in the west, with connections into Iran to the west and Tajikistan and Turkmenistan to the north. Some plans included Mazar-i-Sharif in the north and even a link from Kabul tunneled through the Hindu Kush, to complete what could turn out to be a very useful ring line.

In 2008 then, after more than a century and a half, Afghanistan seems much closer to a real railroad that could help bring resources to market. Numerous web and newspaper reports over the last few years detailing financial assistance from the nearby countries of China, Iran, Pakistan, India, Tajikistan, Turkmenistan, and Uzbekistan to construct rail lines through Afghanistan have recently been announced (Synovitz 2007; Hussain, 2005).

Conclusion

The USA severely failed to measure up with a Marshall Plan at the end of the Soviet–Afghanistan War and even abandoned the country after the Afghan Resistance had helped win the Cold War. Coupled with such lackluster development in the post-9/11 world, these failures provide a strong argument that the USA and its NATO allies should use the resources and plans expressed on this paper as a major means to build up Afghanistan. Anything less would be reprehensible and incomprehensible, now that the relatively rich resource base is fairly well understood.

In sum there are many positive indicators that reasonable development is not only possible, but is underway in Afghanistan, in spite of the many roadblocks and great initial expense required for success. A resurgent Taliban and al Qaeda appear to reflect in part the initial indecisive nation building and developmental lethargy. A strong national resource base, suggested for many years but now proven, offers room for optimism, providing insurgent violence, corruption, and environmental degradation can be kept to a minimum. Only continued firm commitment by the multi-national consortia and their militaries, coupled with well-controlled donations, will keep Afghanistan from slipping back into the chaos so desired by the backward and violent jihadi Islamicists.

References

Anonymous (2000). Afghanistan. Retrieved 24 December 2007 from http://rainforests.mongabay.com/deforestation/2000/Afghanistan.htm.

Anonymous (M. Scheuer) (2004). Imperial hubris: Why the west is losing the war on terrorism. Potomac Books.

Anonymous (2005a). Assessing the coal resources of Afghanistan. USGS fact sheet June 2005-3073.

Anonymous (2005b). Assessing the seismic hazards of Afghanistan. USGS fact sheet April 2005-3038.

Anonymous (2006a). Assessment of undiscovered petroleum resources of northern Afghanistan. Retrieved 24 December 2007 from www.sciencedaily.com/releases/2006/03/060314231913.htm.

Anonymous (2006b). Copper bottomed? *The Economist*, 64.

Anonymous (2007). China secures contract for Afghan copper mine. *News in Brief, Nature, 450*, 599.

Asian Development Bank (2007). Asian development outlook 2007: Afghanistan, Islamic Rep. of. Retrieved 25 December from www.adb.org/Documents/Books/ADO/2007/AFG.asp.

BAAG (British Agencies Afghanistan Group) (2004). BAAG Afghanistan monthly review September 2004. Retrieved 25 December 2007 from www.baag.org.uk/downloads/monthly%20review%2004/52%20-September%202004.pdf.

BAAG (British Agencies Afghanistan Group) (2006). BAAG Afghanistan monthly review September 2006. Retrieved 25 December 2007 from http://reliefweb.int/rw/rwb.nsf/db900sid/EVOD-6UJH7Z?OpenDocument.

Baker, H. D. (1917). The proposed connection of the Russian and Indian railway systems. *Geographical Review, 4*(2), 92–102.

Banks, D. (2002). Guidelines for sustainable use of groundwater in Afghanistan. Norwegian church aid-Afghanistan program (NCAAP), policy document.

Banks, D., & Soldal, O. (2002). Towards a policy for sustainable use of groundwater by non-govermental organizations in Afghanistan. *Hydrogeology Journal, 10*(3), 377–392.

Bearden, M. (2001). Afghanistan, graveyard of empires. *Foreign Affairs* (November/December), 17–34.

Bergen, P. (2007a). Afghanistan 2007: Problems, opportunities and possible solutions. Testimony February 15, 2007 house committee on foreign affairs, 7 pp. Retrieved 25 December 2007 from http://foreignaffairs.house.gov/110/ber021527.htm. Also published in Afghanistan: mission impossible? ESF working paper no 25 of the European security forum, pp. 22–29.

Bergen, P. (2007b). Losing Afghanistan, one civilian at a time. *The Washington Post*, November 18, 2007.

Bergen, P. (2007c). The Iraqization of Afghanistan. Mother Jones, July/August 2007. Retrieved 20 December 2007 from www.motherjones.com/news/feature/2007/07/iraqization_of_afghanistan.html.

Blake, P. (2006). Geology might reshape economic landscape: Afghan study boosts resource view. AAPG explorer, July; Retrieved 24 December 2007 from www.aapg.org.explorer/2006/07jul/afghanistan.cfm.

Bradsher, H. S. (1983). *Afghanistan and the Soviet Union*. Duke University Press.

British Geological Survey (n.d.). Retrieved 20 December 2007 from www.bgs.ac.uk/afghanminerals/docs/Copper_A4.pdf.

Broshears, R. E., Akbari, M. A., Chornack, M. P., Mueller, D. K., & Ruddy, B. C. (2005). Inventory of ground-water resources in the Kabul Basin, Afghanistan. U.S. Geological Survey science investigations report 2005–5090, USGS Afghanistan project product no. 001, 34 pp.

Chayes, S. (2006). *The punishment of virtue: Inside Afghanistan after the Taliban*. NY: The Pengiun Press.

Coll, S. (2004). *Ghost wars*. The Penguin Press.

Crile, G. (2003). *Charlie Wilson's war*. NY: Atlantic Monthly Press.

Dachiku, K., & Tahir, A. (2002). Afghanistan: Present state of the transport infrastructure. Infrastructure Development Institute, Japan, 45 pp. Retreived 25 December 2007 from www.idi.or.jp/tech/afghan_transport.pdf.

Dalton, R. (2007). Mine games. *Nature, 449*, 968–971.

Danner, M. (2005). Taking stock of the forever war. *The New York Times Magazine*, September 11, 44–53, 68–71.

Davis, P. A., & Hare, T. M. (2007). Natural-color image mosaics of Afghanistan: Digital databases and maps. U.S. Geological Survey, data series 245, version 1.0. Retrieved 27 December 2007 from http://pubs.usgs.gov/ds/2007/245/.

Deslesgues, L., & Torabi, Y. (2007). Reconstruction national integrity survey: Afghanistan 2007. Tiri, London, UK, 105 pp. Retrieved 18 December 2007 from www.tiri.org/dmdocuments/RNISS%20Afghanistan.pdf.

Doebrich, J. L., & Wahl, R. R. (2006). The geologic and mineral resource map of Afghanistan. *Geological Society of America, Abstracts with Programs, 38*(7), 166.

Dupree, L. (1973). *Afghanistan*. Princeton, NJ: Princeton University Press.

Fallows, J. (2004). Bush's lost year. *The Atlantic, 294*(3), 68–84.

Fraser, J. M., Chong, C. N., Sanchez, P. E., Sparks, A., Werner, A., & McCarthy, E. (2003). Securing Afghanistan's future: Accomplishments and the strategic path forward. Power Sector: Technical Annex, 61 pp. Retrieved 25 December 2007 from www.export.gov/afghanistan/bus_climate/electric.html.

Goodson, L. P. (2001). *Afghanistan's endless war: State failure, regional politics, and the rise of the Taliban*. University of Washington Press.

Grantham. A. (2006). Railways in Afghanistan, past and future. Retrieved 21 December 2007 from www.ajg41.clara.co.uk/afghanistan.html.

Heckmiller, I. A. (1961). Stream-gauging problems in Afghanistan. *International Association of Scientific Hydrology Bulletin, 6*(3), 35–37.

Hussain, F. (2005). Govt considers railway links with central Asia. Retrieved 25 December 2007 from www.dailytimes.com.pk/default.asp?page=story_8–5-2005_pg5_7.

Ignatieff, M. (2002). How to keep Afghanistan from falling apart. *The New York Times Magazine*, July 28, Section 6: 26-31, 54–59.

Ispahani, M. Z. (1989). *Roads and rivals: The politics of acess in the borderlands of Asia*. London, UK: I.B. Tauris.

Jennings, R. S. (2003). The road ahead: Lessons in nation building from Japan, Germany, and Afghanistan for post-war Iraq. United States Institute of Peace, Peaceworks No.

49, Washington, DC, 41 pp. Retrieved from25 December 2007 from www.usip.org/pubs/peaceworks/pwks49.html.

Klett, T. R., Ulmshek, G. F., Wandrey, C. J., Agena, W. F., & U.S. Geological Survey—Afghanistan Ministry of Mines and Industry Joint Oil and Gas Assessment Team (2006). Assessment of undiscovered technically recoverable conventional petroleum resources of northern Afghanistan. U.S. Geological Survey open-file report 2006–1253.

Millen, R. A. (2005), Afghanistan: Reconstituting a collapsed state. Strategic Studies Institute, U.S. Army War College, Carlisle, PA, 22 pp. Retrieved 19 December 2007 from www.carlisle.army.mil/ssi.

Moreau, R., Yousafzai, S., & Hirsh, M. (2006). Losing Afghanistan: The rise of Jihadistan. Newsweek International Edition, Monday 02 October 2006. Retrieved 25 December 2007 from www.truthout.org/docs_2006/092506R.shtml.

NATO (2007). NATO in Afghanistan: Reconstruction and development. Retrieved 23 December 2007 from www.nato.int/issues/afghanistan/factsheets/reconst_develop.html.

Nelson, S. S. (2007). U.S. teams build infrastructure in Afghanistan. NPR. Retrieved 21 December 2007 from www.npr.org/templates/story/story.php?storyId=16123139.

Orris, G. J., & Bliss, J. D. (2002). Mines and mineral occurrences of Afghanistan. USGS open-file report 02–110, 95 pp.

Patel, S., & Ross, S. (2007). Breaking point: Measuring progress in Afghanistan. A report of the post-conflict reconstruction project, Center for Strategic and International Studies (CSIS), Codirectors F. Barton, K. van Hippel, The CSIS Press, Washington, DC, 127 pp. Retrieved 25 December 2007 from www.csis.org/breakingpoint.

Peters, S. G., Ludington, S. D., Orris, G. J., Sutphin, D. M., Bliss, J. D., & James J. Rytuba (Eds.), and the U.S. Geological Survey—Afghanistan Ministry of Mines Joint Mineral Resource Assessment Team (2007). Preliminary non-fuel mineral resource assessment of Afghanistan. USGS open-file report 2007–1214, 810 pp. Retrieved 25 December 2007 from http://pubs.usgs.gov/of/2007/1214/.

Rasanayagam, A. (2003). *Afghanistan: A modern history*. London, UK: I.B. Taurus.

Rashid, A. (2001). *Taliban: militant Islam, oil and fundamentalism in central Asia*. New Haven, CN: Yale University Press.

Rohde, D. & D. E. Sanger (2007) How the 'good war' in Afghanistan went bad. *The New York Times*, August 12, 2007, 1, 12–13.

Rubin, B. R. (1995). *The search for peace in Afghanistan: From buffer state to failed state*. Yale University Press.

Rubin, B. R. (2007). Saving Afghanistan. *Foreign Affairs, 86*(1), 57–78.

Ruleman, C. A., Crone, A. J., Machette, M. N., Haller, K. M., & Rukstales, K. S. (2007). Map and database of probable and possible Quaternary faults in Afghanistan: U.S. Geological Survey open-file report 2007–1104, 39 p., 1pl.

Scheuer, M. (2006). Clueless into Kabul. *The American Interest., II*(1), 111–119.

Shroder, J. F., Jr. (1977). Feasibility study for monitoring desertification in the country of Afghanistan; Special unpublished background paper for Brian Spooner and the Nairobi report on desertification of the United Nations (UNCOD, 1978).

Shroder, J. F., Jr. (1980a). Mineral wealth of Afghanistan. United Press International report (24 January 1980); published widely, including newspapers in New York, Albany, Boston, Baton Rouge and Omaha.

Shroder, J. F., Jr. (1980b). Afghanistan's minerals. *Business Week*, 27 October 1980, 8.

Shroder, J. F., Jr. (1980c). Special problems of glacial inventory in Afghanistan. In *World Glacier Inventory Proceedings Reideralp Workshop, September 1978 (IAHS-AISH) Publication No. 126, Hydrological Sciences Bulletin* (pp. 142–147).

Shroder, J. F. Jr. (1981). Physical resources and the development of Afghanistan. *Studies in Comparative International Development, xvi*(3–4), 36–53.

Shroder, J. F., Jr. (1982). Afghanistan's unsung riches. *The Christian Science Monitor, 74*(54).

Shroder, J. F., Jr. (1983). The U.S.S.R. and Afghanistan mineral resources. In A. Agnew (Ed.), *International mineral resources a national perspective* (p. 115–153). American Association for Advancement of Science.

Shroder, J. F. Jr. (1987). Afghanistan resources and the Soviet Union. *Geotimes, 32*, 4–5.

Shroder, J. F., Jr. (1989a). Afghanistan resources and Soviet Policy in Central and South Asia. In: M. Hauner & R. Canfield (Eds.), *Afghanistan and the Soviet Union: Collision and Transformation* (pp. 101–119). Westview Press.

Shroder, J. F., Jr. (1989b). Glacierized areas of Afghanistan. In W. Haeberli, H. Bosch, K. Scherler, G. Ostrem, & C. C. Wallen (Eds.), *World glacier inventory, status 1988* (pp. C39-C40 & C346-C353). Teufen, Switzerland: IAHS (ICSI)-UNEP-UNESCO.

Shroder, J. F. Jr. (1989c). Slope failure: extent and economic significance in Afghanistan, Pakistan. In E. E. Brabb, & B. L. Harrod (Eds.), *Landslides: extent and economic significance in the world* (pp. 325–341). Rotterdam, Netherlands: A.A. Balkema.

Shroder, J. F. Jr. (2002a). Resource assessment for Afghanistan and alleviation of terrorism. *EOS, Transactions, American Geophysical Union, 83*(19), S2–S3, AGU Spring meeting, Washington, DC, 7 May 2002.

Shroder, J. F., Jr. (2002b). Afghanistan press release. American Geophysical Union, AGU spring meeting, Washington, DC, 7 May 2002.

Shroder, J. F., Jr. (2003). Reconstructing Afghanistan: Nation building or nation failure? *Geotimes*, 5.

Shroder, J. (2004). Afghanistan redux: Better late than never? *Geotimes*, 34–38.

Shroder, J. F. Jr., & Bishop, M. P. (2004). Glacier change detection in the Hindu Kush of Afghanistan. *EOS Transactions, American Geophysical Union, 85*(47), F778.

Shroder, J. F., Jr., & Bishop, M. P. (2008), Satellite glacier inventory of Afghanistan. In: R. S. Williams, Jr. & J. G. Ferrigno (Eds.), *Satellite image atlas of glaciers*. U.S. geological survey professional paper 1386-F.

Shroder, J. F. Jr., & Tawab Assifi, A. (1987). Afghan mineral resources and Soviet exploitation. In R. Klass (Ed.), *Afghanistan and the Soviet Union: The great game revisited* (pp. 97–134). New York: Freedom House Pub.

Shroder, J. F. Jr., & Watrel, R. H. (1992). Mineral resources in Afghanistan (summary of report for USAID). *AACAR*

Bulletin (Association for the Advancement of Central Asian Research), 5(2), 9.

Shroder, J. F., Jr., M. P. Bishop, Bulley, H. N. N., Haritashya, U. K., & Olsenholler, J. A. (2005), Global land ice monitoring from space (GLIMS) Project Regional Center for Southwest Asia (Afghanistan and Pakistan). In *Mountains, Witnesses of global changes: Research in the Himalaya and Karakoram: SHARE-Asia Project. Developments in Earth Surface Processes* (187–208). Amsterdam: Elsevier.

Synovitz, R. (2007). Afghanistan: China's winning bid for copper rights includes power plant. Railroad. Radio free Europe/radio liberty. Retrieved 25 December 2007 from www.rferl.org/featuresarticleprint/2007/11/ee7d8224-e2f9–4c79-a7ba-b144a26b190c.html.

Strock, C. (2006). Afghanistan reconstruction. Retrieved 20 December 2007 from www.defenselink.mil/home/dodupdate/For-the-record/documents/20061019.html.

TSIA (Transitional Islamic State of Afghanistan) (2004). 14-Province inter-ministerial drought assessment. Ministries of Irrigation, Water Resources and Environment, Rural Rehabilitation & Development, Agriculture & Animal Husbandry, Mines, 6 pp.

UNCOD (1978). *United Nations conference on desertification. Round-up plan of action and resolutions*. New York: United Nations. Retrieved 25 December 2007 from www.ciesin.columbia.edu/docs/002-478/002-478.html.

UNEP (2003). Afghanistan: Post-conflict environmental assessment. United Nations Environmental Programme, 176 pp.

United Nations, 2006. Afghanistan could return to being a failed state. UN press release, Sunday 26 November 2006. Retrieved 25 December from www.scoop.co.nz/stories/WO0611/S00395.htm.

USAID (2005). Afghanistan reborn: Building Afghan democracy, 26 pp. Retrieved 23 December 2007 from www.usaid.gov/locations/asia_near_east/countries/afghansiatn/prt.html.

USAID (2007). Afghanistan road update. February, Issue 65. Retrived 21 December 2007 from www.usaid.gov/locations/asia_near_east/documents/ countries/afghanistan/roadupdate_2007.pdf .

USGS (2006). Water resources assessment, monitoring and capacity building: Ensuring safe, adequate and sustainable water resources in afghanistan. US Department of the Interior, US Geological Survey information sheet August 2006, 2 pp.

Walsh, D. (2006 a). As Taliban insurgency gains strength and sophistication, suspicion falls on Pakistan. *The Guardian, Monday*, 13 November.

Wandry, C. J., Ulmishek, G., Agena, W., Klett, T. R., & Afghanistan Oil & Gas Research Assessment Team (2006). U.S. geological survey and Afghanistan Ministry of mines and industry cooperative assessment of Afghanistan's undiscovered oil and gas. USGS open-file report 2006–1095. Retrieved 24 December 2007 from http://pubs.usgs.gov/of/2006/1095/.

Weier, J. (2002). From wetland to wasteland, 7 pp. Retreived 20 December 2007 from NASA http://earthobservatory.nasa.govStudy/hamoun/.

Westfall, A. O. (1969). Surface Water Investigations in Afghanistan: A summary of activities from 1952 to 1969. Administrative report, U.S. Geological Survey, in cooperation with Water and Soil Survey Department, Ministry of Agriculture and Irrigation, Royal Government of Afghanistan, under the auspices of the US Agency for International Development, 50 pp.

Wheeler, R. L., Bufe, C. G., Johnson, M. L., Dart, R. L. (2005). Seismotectonic map of Afghanistan with annotated bibliography. USGS Afghanistan project product no. 011, open-file report 2005–1264, 31 pp.

Whitney, J. W. (2006). Geology, water, and wind in the lower Helmand Basin, southwestern Afghanistan. U.S. Geological Survey scientific investigations report 2006–5182, 40 pp.

World Bank (2005). The investment climate in Afghanistan: Exploiting opportunities in an uncertain environment. Finance and private sector development unit, south Asian region. *The World Bank*: 67 pp.

World Bank (2007). Afghanistan: Data & statistics. Retrieved 25 December 2007 from www.worldbank.org.af/.