

**Continuing Pistachio Woodland  
Rehabilitation in Afghanistan**



**Pistachio Woodlands TDY – 2: Report**

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## TABLE OF CONTENTS

	Page Number
Executive Summary	3
Introduction/Background Information	4
Report on Each Deliverable #1	5
#2	21
#3	27
#4	36
Appendices	
A– Scope of Work	37
B – Literature Reviewed	40
C - Perspective View of the Samangan Sample Area – Satellite2005 natural color	41
D- Field Data Specifications Pistachio Rehabilitation for the Samangan Area, Afghanistan	42
E - Training Areas Samangan Area Feature Analyst November 22, 2004	43
F - IKONOS satellite image at 1 m resolution compared with SPOT satellite image at 2.5 m resolution and LANDSAT satellite image at 30 m resolution compared with SPOT imagery.	45

## EXECUTIVE SUMMARY

Pistachio woodlands occur in a broad band across the northern part of Afghanistan. Mature trees are about twenty feet high and occur on sloping, relatively arid sites having medium to fine-textured soils.

The Afghan strains of pistachio are capable of withstanding cold and drought. The woodlands have historically served as seasonal pasture for nomadic flocks. Harvested nuts are a world-recognized commodity. The tree is a valuable source of firewood in an area where people depend on wood for fuel. In addition, war and clearing for farming have contributed to the destruction of some populations. Severe drought beginning in the late 1990's resulted in further losses.

This report addresses plans jointly developed by the Afghan Conservation Corps (ACC), the Department of Forest and Range (under the Ministry of Agriculture and Food), and USAID to recover pistachio woodlands and increase their productivity.

Our first objective was to assess woodlands status. Original estimates were suspect, as an overflight last June indicated more pistachio woodland existed than was mapped. In June we also estimated there are about 400,000 ha of total woodland. This focused our study on selected populations in Samangan province as representative of some of the largest remaining forests. We completed a more detailed map of that area, using satellite imagery taken in October of 2005, but supplemented with another documented flyover and field work by Afghan specialists.

Then we worked with the Afghan Conservation Corps and the Department of Forest and Range to develop a specific plan that would provide a demonstration project for community-based pistachio rehabilitation. The goal of this plan is to develop a site-specific conceptual plan for rehabilitation and conservation of pistachio woodlands, considering the benefits and costs to other resources, and emphasizing involvement of the local communities as "owners" of the lands. Objectives include soil and water conservation as well as conserving biodiversity of the Afghan landscape. The Samangan area is a demonstration recovery area, for later application to other remaining pistachio woodland areas in northern Afghanistan. This is to begin in 2006 but is to be developed in a multi-year context.

This project is designed to be an example of integrated resource management. Managing the grazing resource, use and control of expansion of rain-fed agriculture (plowed lands), and reducing watershed concerns (soil erosion and flooding) are also considered. The plan also considers impacts on other resources and mitigation for these impacts, including grazing, rain-fed agriculture, pastoralists (Kuchi), and village culture.

Facets of the plan include community-based ownership and management, protection (guarding) and watershed improvement, and pistachio recruitment through encouragement of natural re-sprouting and plantation development.

This plan will benefit bio-diversity, because it will encourage the development of more natural assemblages of grasses, recover pistachio woodlands (which have high genetic diversity), and provide habitat for more wildlife species.

## Introduction/Background Information

Pistachio woodlands occur in a broad band across the northern part of Afghanistan in at least nine provinces. They occur on sloping, relatively arid sites having medium to fine-textured soils. They are open forests, with higher density on north slopes. Mature trees are about twenty feet high.

The center of crop origin and genetic diversity is in the area of Afghanistan, Iran, and Central Asia. Native pistachio populations in Afghanistan are potential repositories of genes for drought tolerance and cold hardiness. Trees in Afghanistan are harvested primarily from native seedling trees, maintaining the genetic diversity of the species within the complex ethnic diversity that characterizes the people of northern Afghanistan. Pistachio was once a major export product of the region, and Afghan nuts are recognized on the world market for their intense flavor and dark green color. They are smaller and less uniform than those from orchards of grafted trees.

Pistachio nuts are rich in heart-healthy oil, low in saturated fat, and are high in dietary fiber, vitamin B6, thiamine, phosphorus and copper. Pistachio oil is used both medicinally and cosmetically. Resin from the trunk and branches can be obtained by tapping, and has medicinal applications (to stop bleeding and dress wounds). The mesocarp (fruit hulls) and leaf galls (caused by insect infestation) have been used for tanning leather, and for dyeing.

Pistachio is capable of withstanding cold and drought and grows on steep hillsides where it helps prevent erosion. The woodlands have historically served as seasonal pasture for nomadic flocks, providing shade, browse and forage, while receiving the benefit of manure fertilization. The tree is a valuable source of firewood in an area with cold winters where people depend on wood for fuel. This has contributed to the destruction of some populations. Years of war with the Soviet Union resulted in extensive cutting of the woodlands, as people stockpiled wood for fuel, and as military forces eliminated cover for their opponents. Severe drought beginning in the late 1990's resulted in further losses.

The United Nations Environmental Programme, in cooperation with Afghan advisors, evaluated the condition of the northern pistachio and juniper woodlands in the provinces of Herat, Badghis, Kunduz, and Takhar, Afghanistan between 6 September and 10 October 2002. (UNEP, 2003). UNEP used satellite image analyses to quantify changes in pistachio woodland in Badghis and Takhar provinces between 1977 and 2002. In 1977, woodlands were found on 55 and 37 per cent of the land base in Badghis and Takhar provinces, respectively. Tree densities of 40 to 100 trees per hectare were observed. In 2002, satellite imaging no longer detected woodlands in either province, indicating a reduction in tree density to below 40 trees per hectare, if not complete deforestation. More intensive data generated in this project indicate a greater number of trees remain, but impacts are nonetheless severe.

UNEP found no seedling regeneration in woodland areas visited in 2002. They attributed that to a combination of drought and overgrazing. The destruction of the woodland continues, with recent (April and November 2005) reports of illegal felling of trees in both Samangan and Baghlan provinces.

This report addresses plans jointly developed by the Afghan Conservation Corps, the Afghan Department of Forestry, and USAID to recover pistachio woodlands and increase their productivity. We will address creating a detailed inventory of the demonstration area and a specific plan to conserve biodiversity, rehabilitate and conserve pistachio while considering other resource concerns and benefits.

## Deliverables

Deliverable # 1: A map on paper and on CD of pistachio woodlands in selected regions, derived from satellite image interpretation with ground truth from aerial flyover and ground-truth by Afghan scientists.

In June of 2005 we produced a map (Grauke and Shovic, 2005) of all known pistachio woodland locations based on literature, consultation with Afghan experts, and existing data. This map is at a scale of 1:1,000,000, and a reduced-size version is in Figure B. It also includes satellite mapping of pistachio woodlands completed in 1993.

From this map and consultation with our Afghan counterparts, we selected two sample areas (Badghis and Samangan). The current project covers the Samangan area.



Consultation with Afghan technical specialists

Description of the Samangan Area (See Figure A. for general location):



Photo showing Samangan Area

Afghan experts agreed this was one of the two most highly productive pistachio areas in Afghanistan. It is approximately 60,000 ha per Afghan expert estimate with a low level of cut-over lands. The UN Landcover map of 1993 (UNEP, 2003) indicates extent of pistachio as only 2,135 ha. We obtained a 2005 natural color satellite image of the Samangan area during our project trip at a scale of about 1: 10,000 (Appendix C). It shows considerable difference in reflectance between mountainous regions and rangeland/cropland at lower elevations. This corresponds loosely to pistachio woodland areas as mapped by the landcover project and surrounding rangelands. This supports the Afghan assertion that this area has been only moderately cut over in recent years.

Even though this site was close to Kabul, it was unavailable for ground access during the project timeline. However, aerial reconnaissance and consultation with persons who had been on the site provided a database supporting the selection of this site as representative, and some information on the status of soil erosion and existing pistachio woodland.

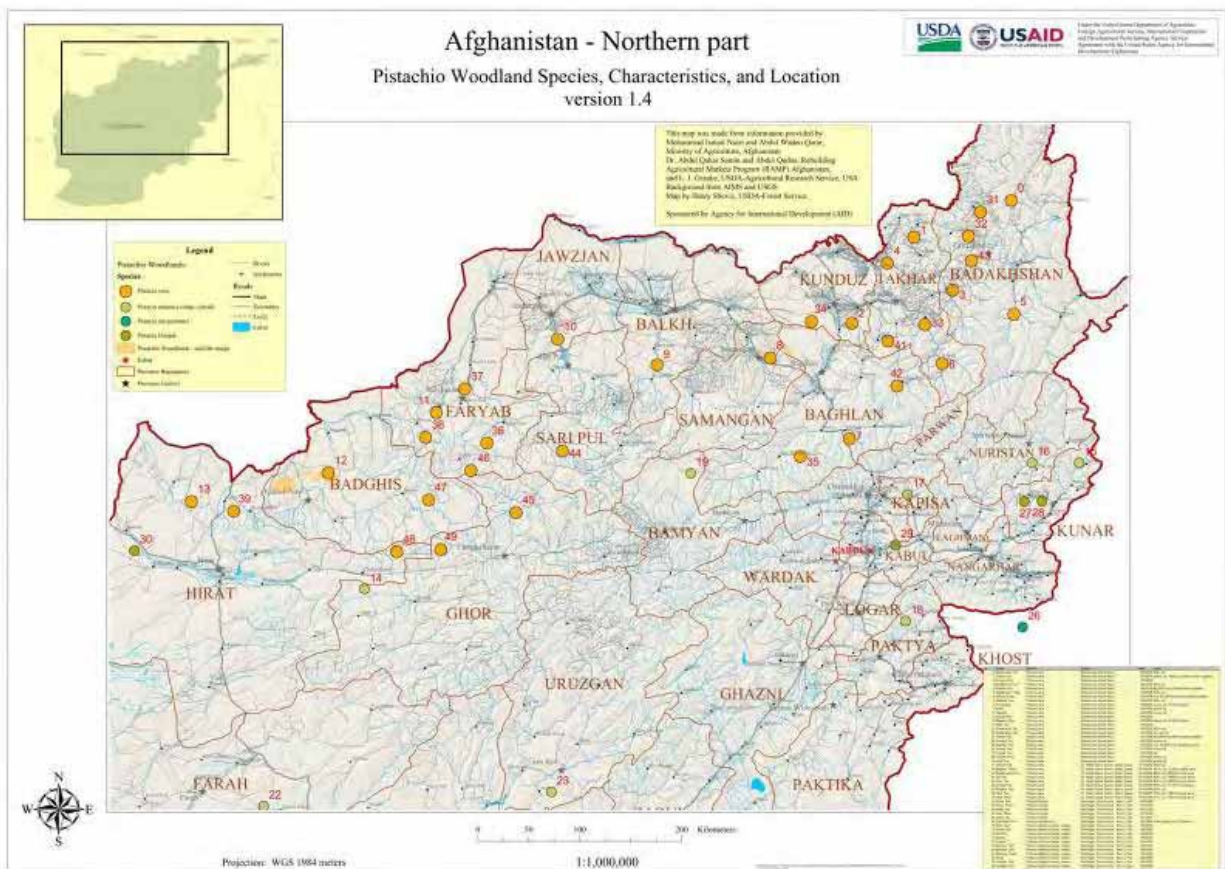
Water-based soil erosion has occurred in this province. Most erosion is occurring on steep cut-over and existing woodlands that are grazed, but have not been plowed. This is based on analysis of photographs taken by earlier project personnel.

Since all records, surveys, and inventories were destroyed in the recent wars, we accomplished site selection by interviewing Afghan experts, gathering available data (primarily satellite imagery projects) and reviewing scientific literature, including vouchered specimens in herbaria.

Figure A. Overview of Sample Area



Figure B. Afghanistan Pistachio Distribution and Species



## Methods for the Samangan Pistachio Inventory

This TDY emphasized completing a more detailed inventory of the Samangan area. Because of limited ground truth and access for mapping personnel, satellite imagery was used to map the Samangan Recovery Area with accompanying ground and aerial data to produce maps showing tree density, location, and extent. Because pistachio woodlands have a relatively low density (40 to 200 trees/ ha), LANDSAT satellite imagery (30 m resolution) was not likely to be useful. Previous mapping using LANDSAT (UNEP, 2003) missed existing pistachio woodlands. This is shown by a flyover of Badghis province (near Qala-I-Naw) in June of 2005 (Figure C). This flyover indicated existing pistachio woodlands occur outside of the mapped area. Also, interviews with Afghan scientist and technicians indicated there are far more remaining pistachio woodlands (Figure B).

Therefore a more detailed inventory was undertaken. Because of poor ground access, a satellite-based inventory was proposed, but with imagery having resolution sufficient to “see” pistachio trees, and ground truth to determine the accuracy and precision of the satellite interpretive process. The French SPOT satellite was chosen from many potential platforms for its reasonably-sized footprint analysis, ability to “aim” at a selected location with short lead times, its moderate cost, and adequate resolution. Other platforms can give better resolution, but the footprint is so small it is not feasible with computing power available. See Appendix F for a comparison of IKONOS (1 m resolution) to SPOT (2.5. m resolution). These more accurate maps of pistachio woodland can aid the Department of Forest and Range and the Afghan Conservation Corps (both in the Ministry of Agriculture and Food) in planning rehabilitative activities such as tree planting and erosion control, and targeting communities to pilot community management of these woodlands. Preliminary analysis shows 2.5 m resolution SPOT panchromatic imagery can show individual trees. (Figure D).

Two sample areas were proposed for this work (Badghis and Samangan). These were selected both having the maximum area of pistachio based on the Preliminary Map. (Figure B and Grauke and Shovic, 2005). Satellite footprints were selected in these areas, using additional criteria as follows:

- Presence of ground control points (such as cities)
- Accessibility via road and air: both areas are in low hostility zones
- Within the 1971 mapped extent of pistachio by Frietag (Grauke, 2005) (total of 6,701,172 ha.)
- Include pistachio mapped in the earlier landcover map (UNEP 2003)
- Presence of field data from earlier TDY's: Both Badghis and Samangan have limited field data (overflights and photos).

Figure C. Flyover Badghis Province in June 2005

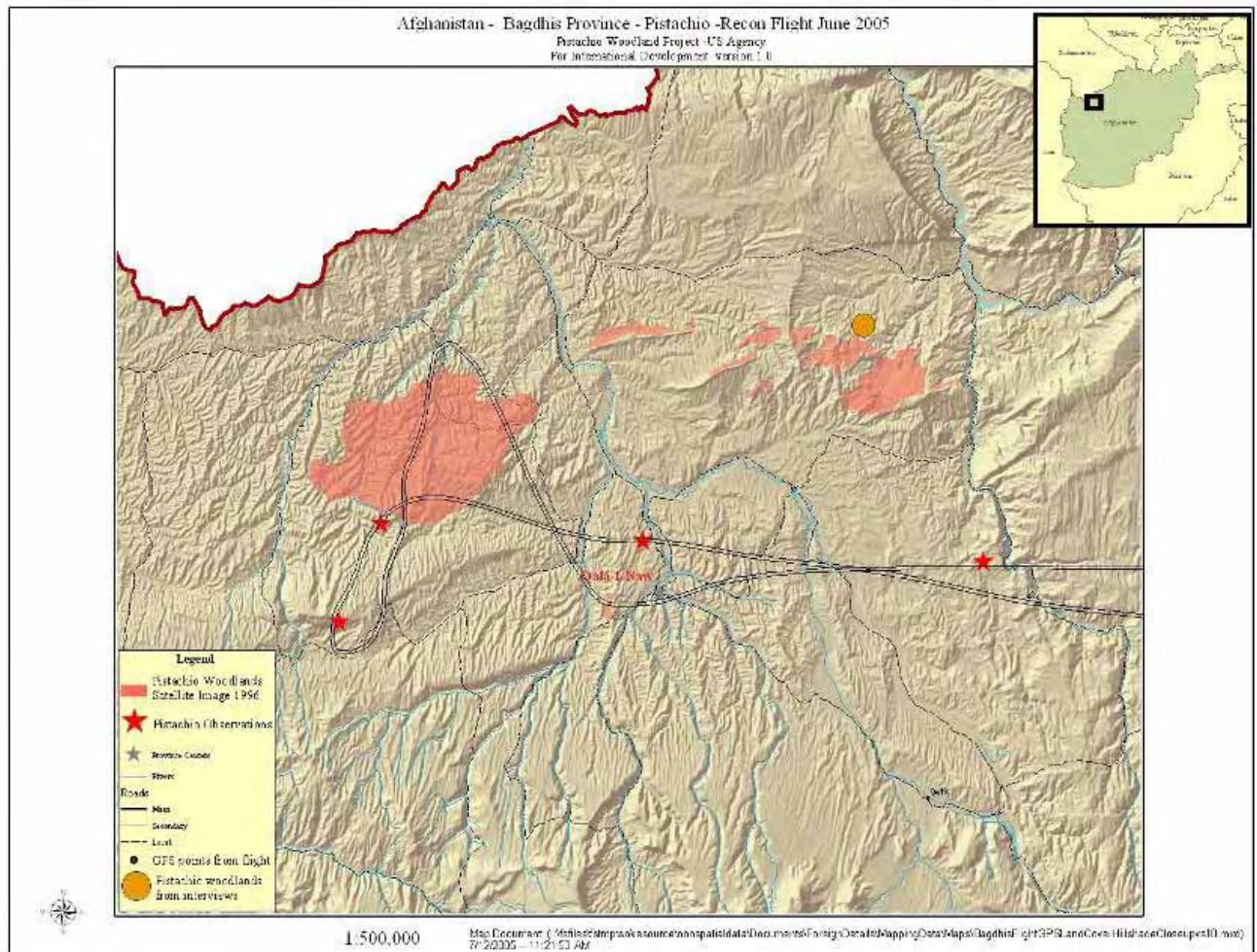
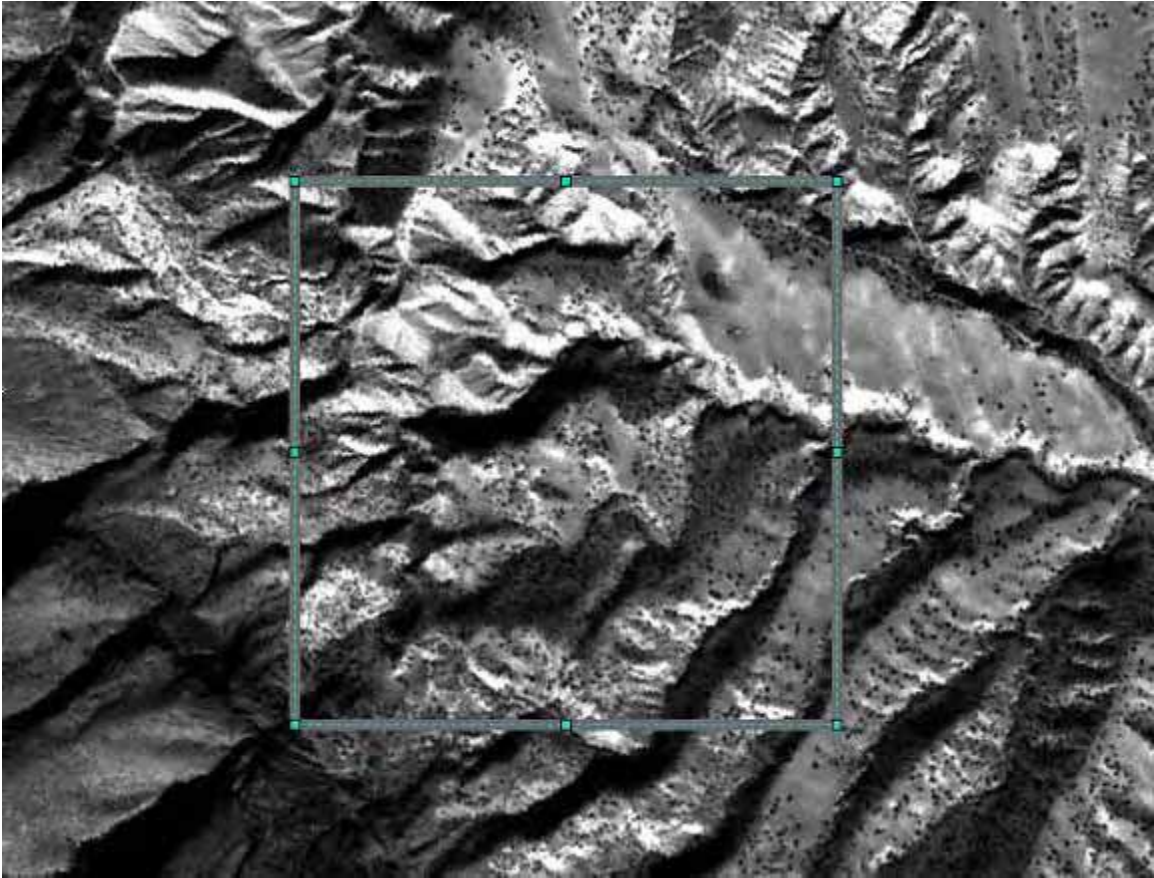


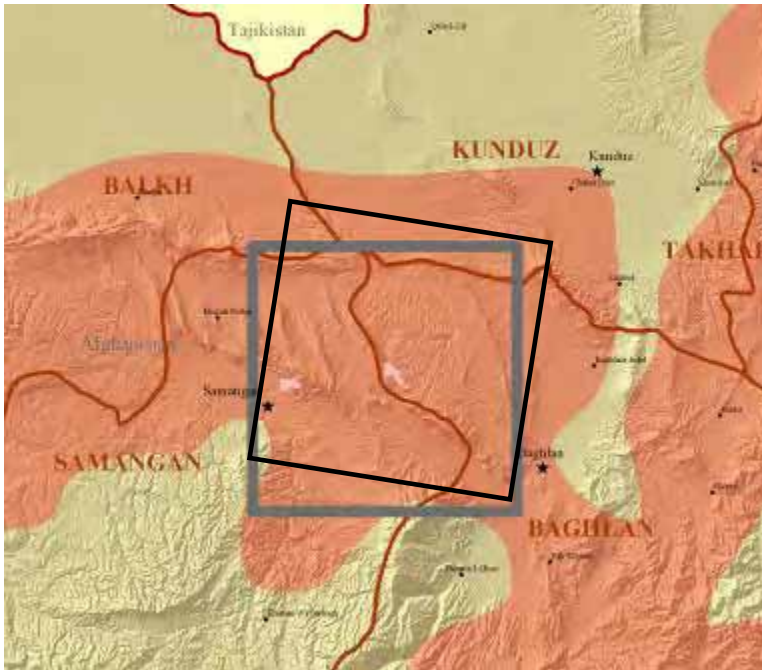
Figure D. SPOT Satellite Imagery at 1:10,000 Scale



SPOT satellite imagery is available only on a request basis, unless there is archival imagery. Because no archival imagery exists for the sample area an image was requested for the footprint area in Figure E. Scale is 1:700,000. Rust color is the range of pistachio woodland in (Grauke, 2005). Brown lines and labels are provinces. Pink areas are satellite-based pistachio mapping using LANDSAT (UNEP, 2003). The gray rectangle is the approximate SPOT satellite footprint.

Because of the short time frame available for acquisition (one month) only the Samangan area was obtained. The actual footprint is shown in Figure E as a black polygon.

Figure E. Samangan Sample Area



This satellite image is 3,600 km sq, or about six percent of the maximum range of pistachio as identified from the 1971 mapped extent. As obtained, the satellite image was only approximately geo-referenced. Point locations were about 500 meters displaced from points on the USGS digital elevation model of the Afghanistan area. Therefore it was geo-rectified to fit within 20 meters. Projection is UTM WGS 1984 Zone 42 meters.

Ground truth was collected both by an aerial flyover and by an Afghan scientist on the ground. The aerial flyover included 185 geo-referenced oblique photographs collected from the right and left side of a small fixed-wing airplane and is described under Deliverable #3.

Ground field data were collected by Mr. Mohamad Ismail Nasri, Technical Officer, Afghan Conservation Corps, Department of Forest and Range, Ministry of Agriculture and Food. He is familiar with the area. His field trip was three days (Nov. 22, 23, and 24, 2005). He used a GPS, field notebook, and digital camera to record his observations at 26 mapped locations. He provided data on tree density, village location and size, erosion, pistachio cut-over areas, irrigation potentials, pistachio re-sprouting, access, agricultural practices (grazing and plowed land), and made initial contacts with village leadership. His photographs are contained in the folder "Samangan pictures 22,23.11.2005". The field trip task description is in Appendix D.

Though the raw satellite image shows probable pistachio trees (Figure D), the image itself too large for efficient manual mapping of pistachio woodland. Therefore a pattern recognition software package was used (FEATURE ANALYST for ARCGIS) to automatically map the woodlands. Training areas

were located (Appendix E) to help the software “learn” the pistachio woodland signature on the image. The aerial overflight was used to “ground truth” the training areas. Both the flyover and ground data were used to train and improve the feature mapping and act as a check for quality control. For example, in some areas in northern Afghanistan there are woodland areas that are actually are juniper stands. These appear similar to pistachio woodlands on a satellite image. The aerial flyover identified these areas.

Figure F Shows the results of the iterative automated process. Yellow is scattered trees and green is denser stands. Compare to Figure G which shows the underlying SPOT image at a scale of 1:24,000. Though existing pistachio woodlands were identified, there was much “clutter” or polygons that were mis-identified as woodlands, but when viewed with the image did not have the proper signature for pistachio. Automated and manual attempts to remove this “clutter” were not successful, due to lack of time and available computing power. Therefore a second pass was made using manual techniques to map the final polygons at a scale of 1:10,000. The automated process did save time, though in focusing attention on probable pistachio areas rather than attempting to canvass the entire image without guidance.

There were unusable areas on the image. Shade (uniformly black) occurred in about five percent of the image. Pistachio woodland was inferred to be part of the shade if surrounded by verifiable woodland. Part of the image was slightly out-of-focus (possible because of sensor angle) in the extreme NW corner, so accuracy may be lower in that area.

Figure F. Results of automated classification of pistachio woodlands on SPOT imagery. Scale 1:24,000

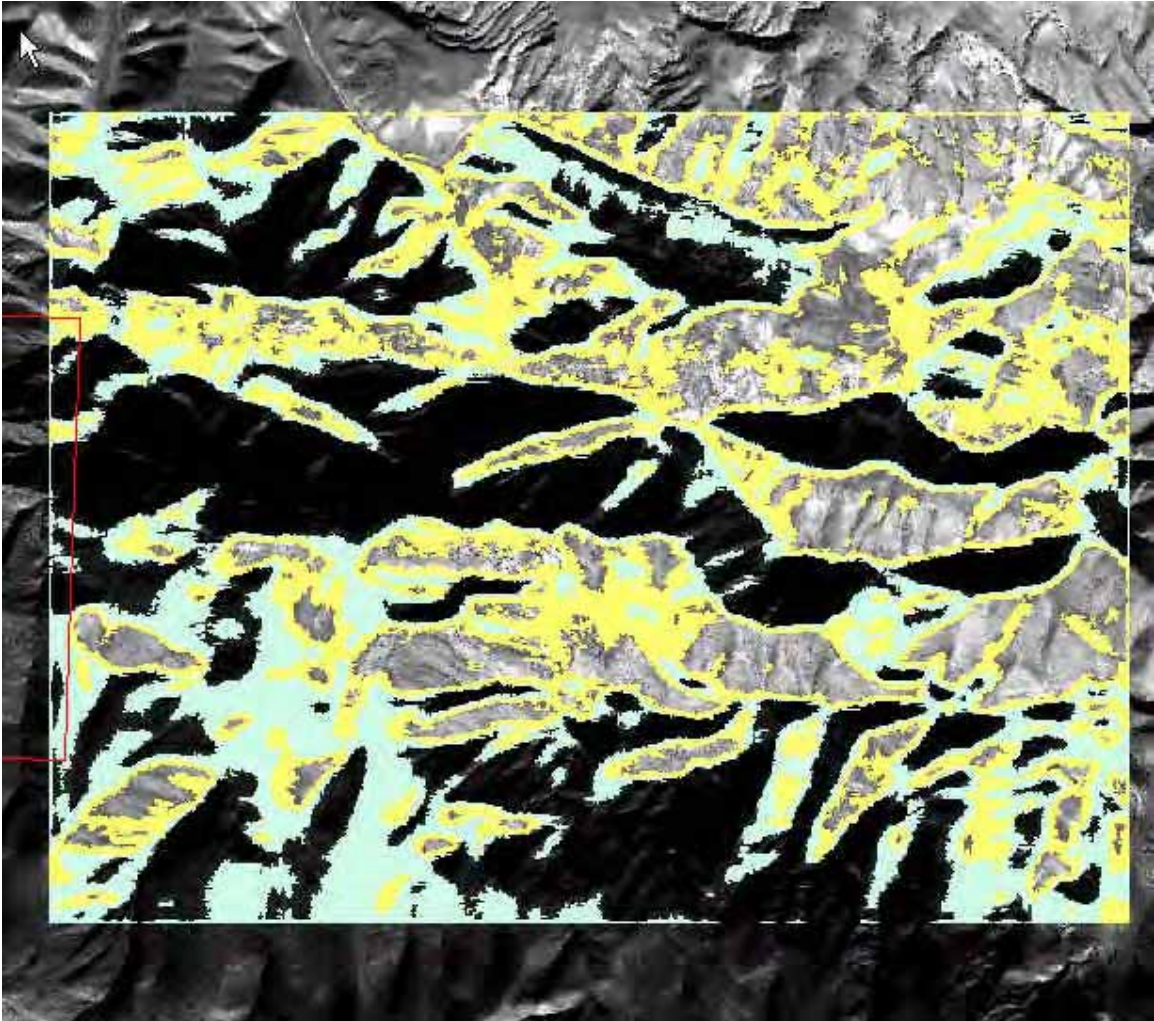


Figure G. Underlying SPOT imagery for automated classification. Scale 1:24,000



## Results for the Samangan Pistachio Woodlands Inventory

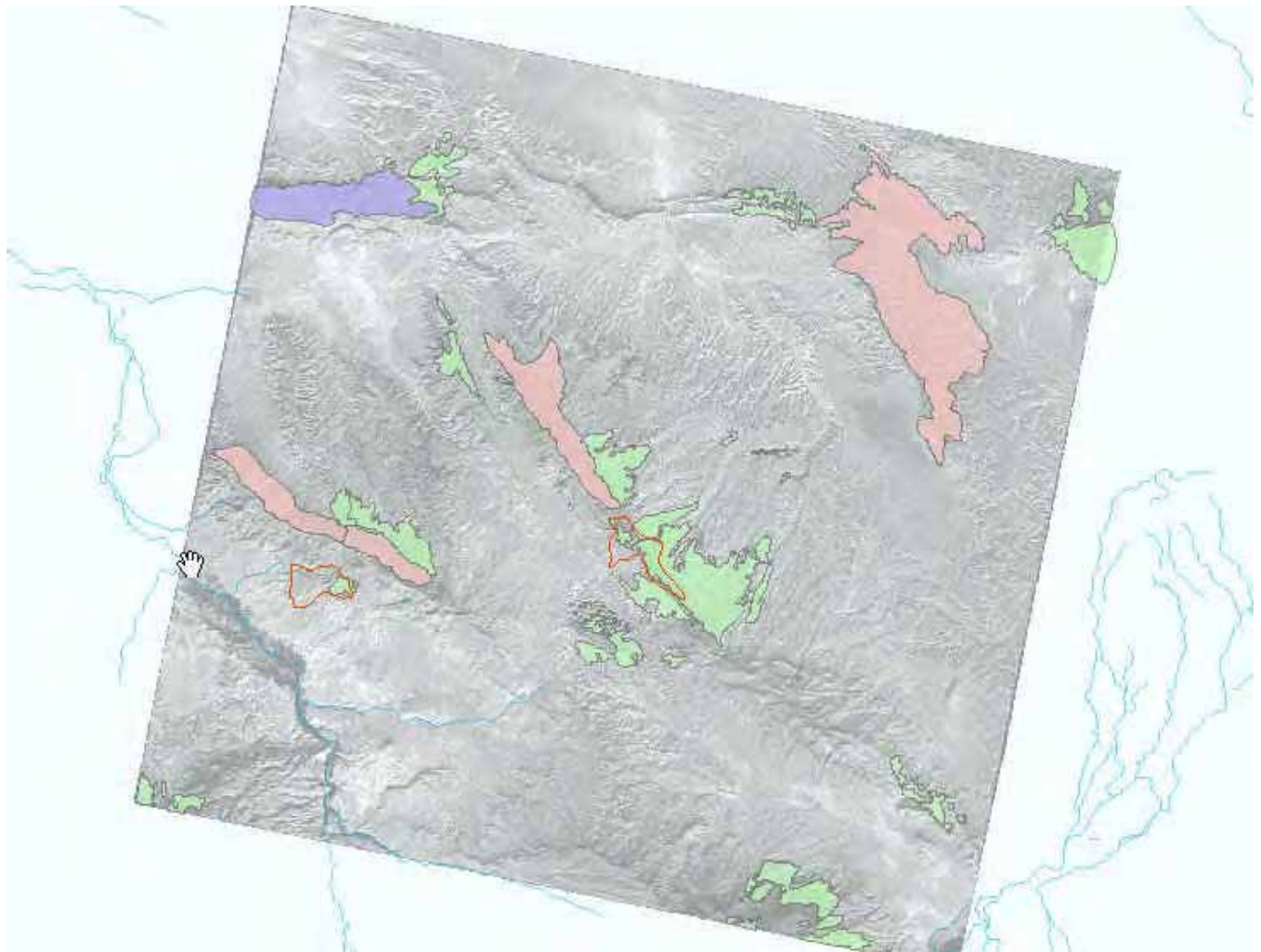
Figure H shows pistachio extent and distribution for the 60km by 60 km (3600 km) Samangan area. Spatial data is in the folder "SpatialData" on the CD and is in the geodatabase AfghanPistachioGeodatabase.mdb. Feature class is PistachioLocationsGeoDB. Recently-burned areas were identified through lower albedo and shape. Total area presently in pistachio woodland is 20,111 ha, which includes 3,322 recently-burned woodlands where trees remain standing. This represents 5.5 percent of the entire area remaining in pistachio woodlands. The entire Samangan area is in the historical range of pistachio and its potential habitat (sloping land not within alluvial basins and not sand-covered) appears to be about 80 percent of the entire Samangan area. So remaining pistachio is about six percent of its long-term coverage. However, interviews with Afghan experts indicate over 50 percent of the remaining pistachio has been cut in the last 25 years, meaning pistachio was historically at least twice as abundant as in the present.



Comparing the inventory with the earlier UN mapping, it appears that there is more pistachio present than earlier thought (Figure I). Green shows as SPOT-based inventory, and red outlines show the LANDSAT based map units. The LANDSAT-based map shows 2,135 ha in the sample area and the SPOT-based inventory shows 20,111 ha, a 9.4 fold increase. The latter estimate is reasonably close to the estimate of 28,800 ha from the Preliminary Map (Map in Figure B, calculating 48 percent remaining from 60,000 ha in Grauke and Shovic, 2005). There is also only about 30 percent overlap between the two inventories. This is probably due to lower ground-truth capacity and a lower-resolution image in the earlier mapping (see Appendix F for a resolution comparison).

In terms of distribution, it appears remaining pistachio is concentrated in higher, more inaccessible areas away from major roads and towns. This may not be a time-stable distribution, since during the November field review, our representative met a local farmer with an ax, who was intending to cut pistachio that day.

Figure I. SPOT-based pistachio inventory with LANDSAT-based inventory.



For density measurements, images of trees or bushes were counted in a one ha square (Figure J). Fourteen representative locations were used. Counts

were 12, 15, 20, 60, 40, 25, 25, 35, 70, 30, 30, 27, and 60. This averages 36 trees/ha. Five counts were done on the ground during Mr. Nasri's field trip. His figures averaged 5.0 times this value. Many pistachio plants are bushlike in heavily used areas, resulting from past cutting (Figure K). These evidently did not show on the satellite image. So the final estimate was adjusted by a factor of five to account for the smaller trees and bushes. Final estimates are 180 trees / ha as an average, with the range from 60 ha to 300 trees/ha. This is higher than previously estimated, and is consistent with Afghan scientist estimates. No consistent differences in spatial pattern were noted between polygons across the sample area.

Figure J. Pistachio Density Count on 1:10,000 scale SPOT imagery

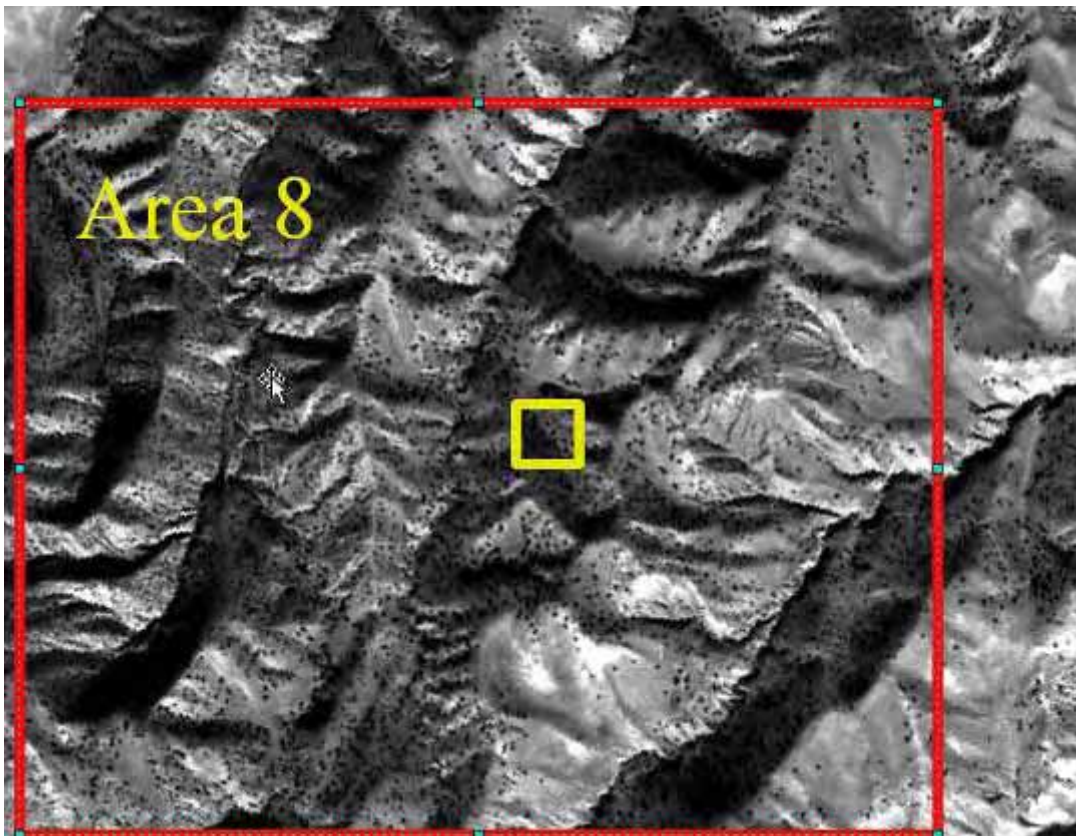


Figure K. Pistachio bush-like form



**Deliverable # 2** This is a report on new information regarding the status of pistachio woodland areas, including an update on direct seeding, a report on the flyover of pistachio woodland , and a report on the pistachio ecosystem vulnerability as rated by the World Wildlife Federation.

### Pistachio Woodland Update

On Nov. 23, 2005 a field review by Mr. Nasri (ACC) was conducted on the Robatak (25 km WNW of Baghlan City) and Takht – e-Rustam (2 km SSW of Samangan City) direct seeding areas. The following is based on discussions with Mr. Nasri about his field investigation. For locations of these two project areas, please see the map “Pistachio Woodland Community Rehabilitation Project: Samangan Area – Forest and Range Department, Ministry of Agriculture and Food, and the Afghan Conservation Corps, November 2005 – Version 1.3” by Henry Shovic, (Acrobat file: SamanganPistachioCommunityPlanAnalysisvs13.pdf). Schematics of this area are shown below.

#### Robatak Direct Seeding Project Area

This is an update of an existing project. In 2004, 10,000 previously-dug pits were seeded. On Nov 23, 2005 5,098 pits (49 percent) had live seedlings. Plans are to reseed 5,098 pits in December of 2005 and January of 2006.

#### Takht-e-Rustam Direct Seeding Project Area

This is an update of an existing project. In 2003, 10,000 sites were seeded. On Nov. 23, 2005 8,115 pits (81 percent) had live seedlings (picture of two year olds). In 2004 10,000 other pits were seeded. Of these, 9,500 pits had germination. On Nov. 23, 2005 4,473 (45 percent) of these pits had live seedlings. This low survival was probably due to a severe hail storm in 2004. Plans are to replant the 7,412 failed seedlings in December of 2005 and January of 2006. Also, 10,000 more pits will be dug (with recommended terraces), and these will be seeded.

### Flyover of Pistachio Woodland

A flyover was completed on November 18, 2005. It included the Samangan area in some detail and the Badghis area as a part of a relatively comprehensive flyover of the entire historical range of pistachio. Two photographers (Clark Fleege, USDA and Linda Norgrove, UNOPS), a flight manager (Henry Shovic), and an Afghan scientist familiar with the geography and pistachio distribution (Mohamad Ismail Nasri) were on the flight. The flight plan is included in Figure L. The pink area is the historical range of pistachio (Grauke, 2005). Though details are only available for the Samangan area a review of all photography indicates little pistachio remains in areas outside of these two

regions. Note that this flyover did not include the Takhar or Kunduz area where there are reputed to be remnant populations.

Photography was correlated using camera time stamp with GPS times and locations. Where GPS data was incomplete, manual GPS locations and times were obtained from the cockpit GPS. Other areas were interpolated where neither of these data types was available. Locations are generally plus or minus one minute. Elevation above ground level was generally 2750 to 3000 feet. Speed was 78 to 170 knots. The GPS spatial data for the entire flyover is in geodatabase format: AfGeoDatabasewnew.mdb – XPOSNPNT111805GeoDB. The flight path (FlightPath111805.shp) was extrapolated from this data (Figure L).

Though photographs are available for the entire flight path (in the folder AllFlyoverPhotos11182005), they were only correlated for the Samangan sample area (in the folder “FlightPhotosSamanganFinal”. The “Right Side” photos have time stamps on the photographs. The “Left Side” photos have the time stamp in the photo title. Each has an index number which correlates to a time position on the flight path. It is expressed as an attribute of the spatial data (in geodatabase AfGeoDatabasewnew.mdb – Feature Class XPOSNPNT111805GeoDB).

Figure M shows the details for the Samangan area. There are 185 catalogued photos in this portion of the flight. These were used to establish “ground truth” for presence and density of pistachio in the Samangan area. The blue line identifies the flight path. Representative time stamps are from filtered GPS data (AfGeoDatabasewnew.mdb – XPOSNPNT111805GeoDBFiltered). See Figure N for examples of photographs with pistachio trees. Figure O shows a juniper woodland, which could be misidentified as pistachio on a satellite image. However, its’ environment and elevation is not within the pistachio areas. Note that each photo is an oblique, so scale and distance from the GPS point varies and photo location is plus or minus one minute.





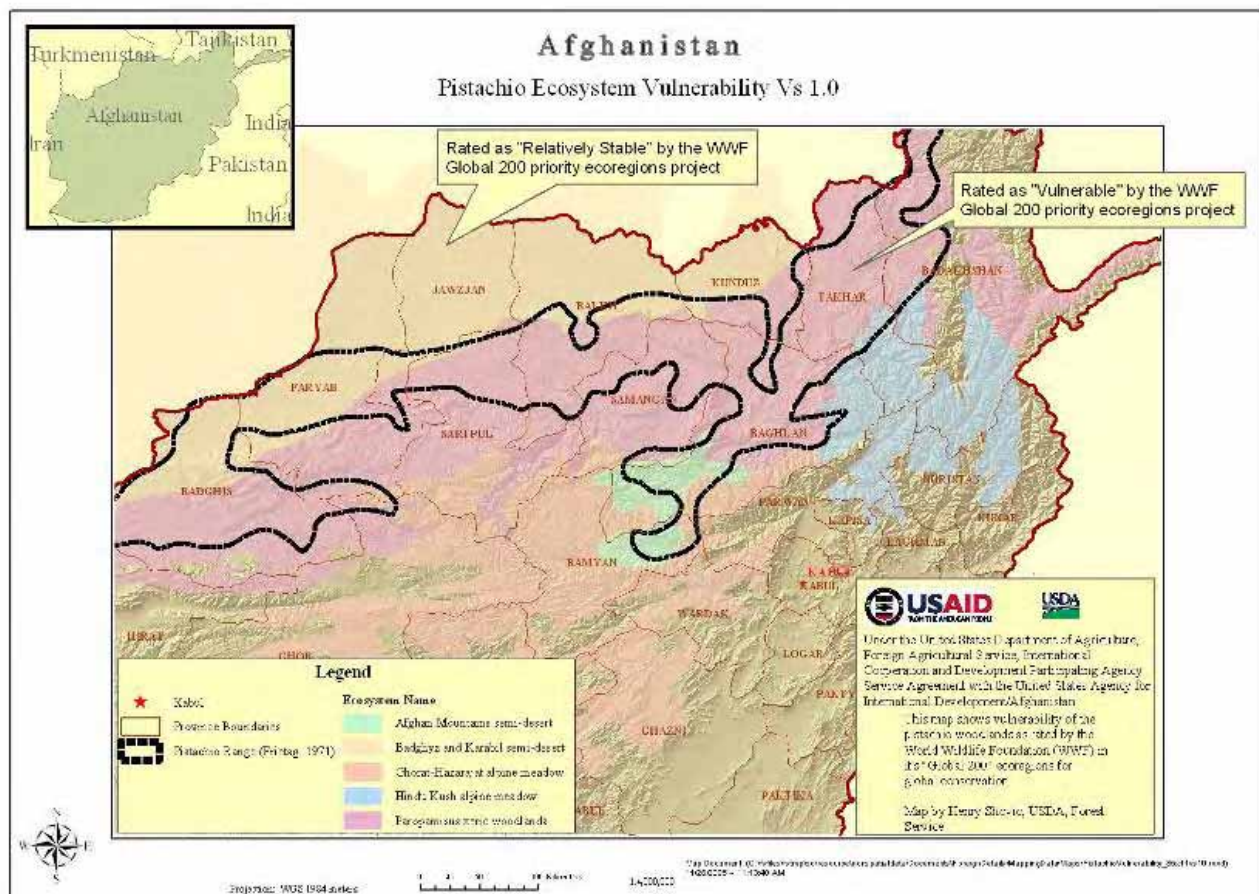
Figure O. Juniper woodland in the Badghis area



#### Vulnerability of the Pistachio woodland ecosystem

The World Wildlife Fund has a global eco-region map from which it chooses 200 globally-important ecosystems. The majority of the woodland range falls in the Paropamisus xeric woodlands. This eco-region in Afghanistan has been rated in this system as “Vulnerable”.

Figure P. Vulnerability of the pistachio woodlands



**Deliverable # 3:** A conceptual plan for community management of pistachio woodlands with technical and labor support from the Afghan Conservation Corps, through the Department of Forest and Range, first focused on target communities where the Afghan Conservation Corps has already identified some interest. This plan should incorporate the technical recommendations and tasks in the reports by Grauke and Shovic in TDY#1.

This plan was developed cooperatively in a set of meetings with the following individuals:

- Mr. Mohamad Ismail Nasri, Technical Officer, Afghan Conservation Corps, Department of Forest and Range, Ministry of Agriculture and Food
- Mr. Hazrat Hussain Khaurin, Director, Forest and Range Department, Ministry of Agriculture and Food
- Mr. Abdul Ghani Ghuniani, Forest and Range Department, Ministry of Agriculture and Food
- Mr. S. Aka Anam, Food and Agriculture Organization of the United Nations
- Mr. Abdul Wali Modaqiq, United Nations Environment Programme, Ministry of Irrigation, Water Resources, and Environment
- Dr. Henry Shovic, PhD, United States Department of Agriculture, Participating Agency Service Agreement, United States Agency for International Development – Afghanistan
- Mr. Mohamad Hassan Keshtyar, former president of the Forestry Department
- Mr. Abdul Wadood Qedees Qarar, Greenbelt Supervisor for Kabul, Afghan Conservation Corps, Department of Forest and Range, Ministry of Agriculture and Food
- Ms. Linda Norgrove, Project Officer, United Nations Operations

See the accompanying map for details and reference data. The map is titled “Pistachio Woodland Community Rehabilitation Project: Samangan Area – Forest and Range Department, Ministry of Agriculture and Food, and the Afghan Conservation Corps, November 2005 – Version 1.3” by Henry Shovic. The map is 36 inches x 48 inches, so is schematically represented the two maps below (Figure Q and close-up Figure R).

Figure Q. Schematic of the Samangan Pistachio Project Area (SamanganPistachioCommunityPlanAnalysisvs13.pdf)

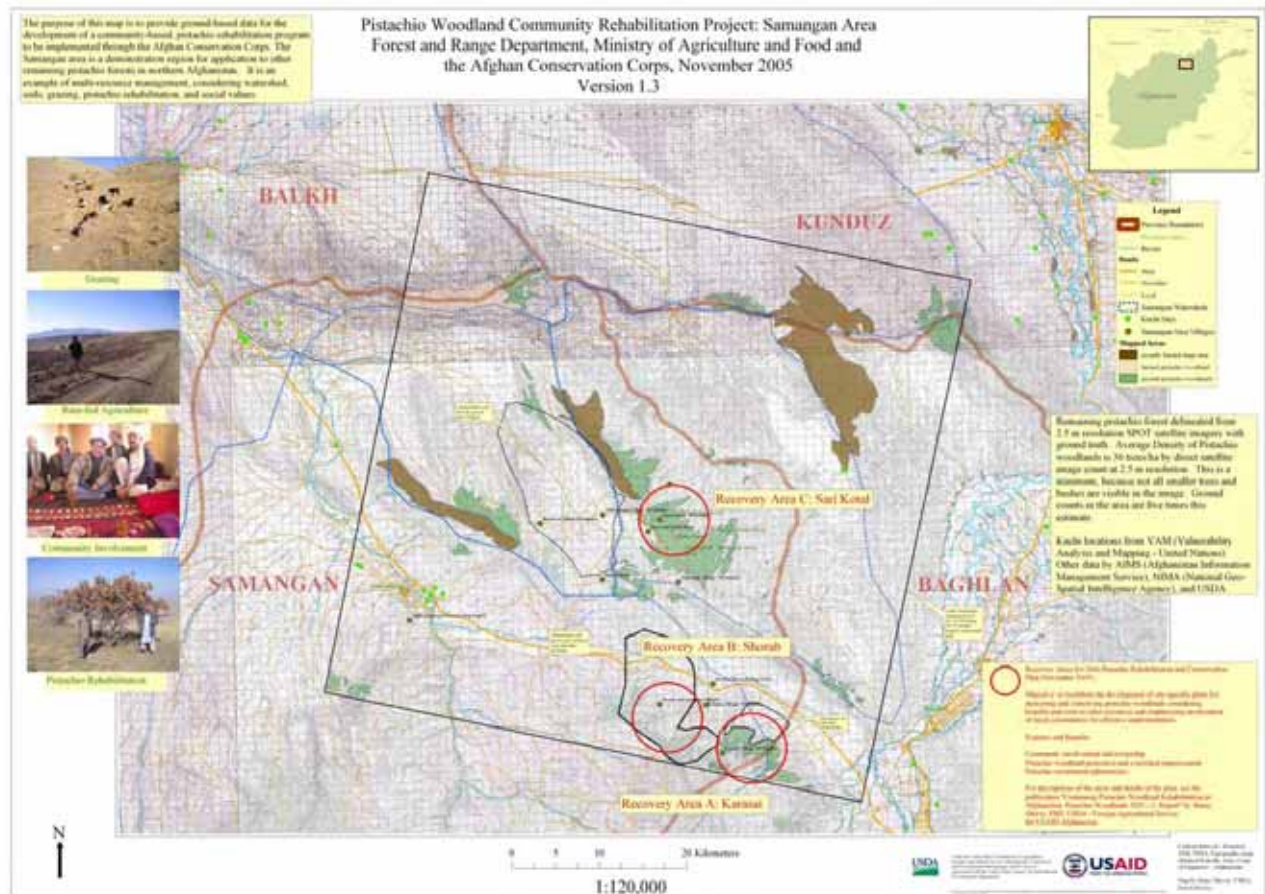
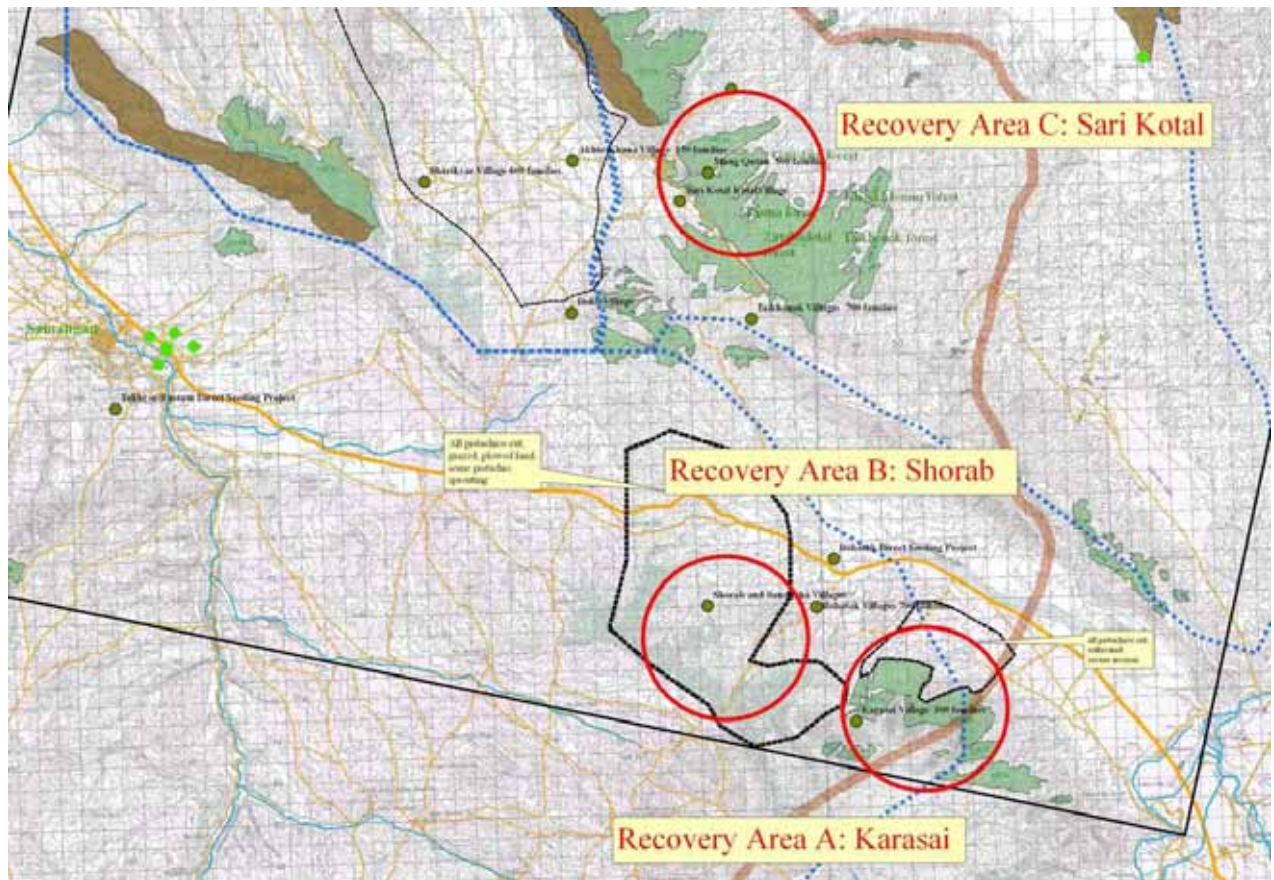


Figure R. Close-up of the Samangan Project Recovery Area



Data used for this plan included the Samangan area pistachio woodlands inventory derived from satellite imagery and ground truth provided by an aerial flyover on October 18, 2005 and by field data from a field trip by Mr. Nasri on Nov 23, 2005 (both described elsewhere in this report) as well as experiences of the above-mentioned individuals in the area. These experiences included past work by Mr. Khaurin and Mr. Nasri building community-oriented conservation plans in Afghanistan.

The goal of this plan is to develop a site-specific conceptual plan for rehabilitation and conservation of pistachio woodlands, considering the benefits and costs to other resources, and emphasizing involvement of the local communities as “owners” of the lands. Objectives include soil and water conservation as well as conserving biodiversity of the Afghan landscape. The Samangan area is a demonstration project, for later application to other remaining pistachio woodland areas in northern Afghanistan. This is to begin in 2006 but is to be developed in a multi-year context.

The Samangan Demonstration Area was chosen because it has a recent inventory of pistachio woodlands, it has one of the better remnant pistachio populations based on local knowledge and previous inventories, it has good road access and Afghan forestry specialists are familiar with and interested in the area. Also, recent field reconnaissance (including village contacts) was available from the field reconnaissance done by Mr. Nasri.

A recent inventory showed over 16,000 ha of remaining unburnt pistachio woodland in the study area. Present density is between 36 and 150 trees/ha based on this inventory. Pre-war estimates (25 years ago) are 200 trees/ha on average with up to 400 trees/ha in some areas. The project goal is to approach 400 trees/ha on good growing sites and 200 trees/ha on other sites.

This project is designed to be an example of integrated resource management. Managing the grazing resource, use and control of expansion of rain-fed agriculture (plowed lands), and reducing watershed concerns (soil erosion and flooding) are also considered.

The plan also considers impacts on other resources and mitigation for these impacts, including grazing, rain-fed agriculture, pastoralists (Kuchi), and village culture.

Criteria for site selection:

- Community is willing and able.
- Labor source is present
- Existing woodlands are close to labor source
- Water for irrigation is close
- Access is adequate (roads)
- Significant pistachios remain in area
- Natural re-seeding is occurring
- Erosion can be reduced
- Flooding can be reduced
- Minimum conflicts with pastoralists (Kuchi)

- Compatibility with other resource needs

#### Features of the Plan:

There are three facets of this plan.

1. Community Involvement
2. Protection and Watershed Improvement
3. Pistachio Recruitment

#### Community Involvement

Though almost all pistachio woodlands are government-owned, local villagers generally consider this land “theirs” and have most control of its use. This plan uses this cultural fact to help them take better care of those lands through increasing awareness of good land management and the long-term benefits to them. Training and education in these concepts will be provided by Forest and Range Department staff (Figure S), with emphasis on how good land management will benefit the local villagers.

Figure S. Mr. Nasri with Shura in ShariKyar village



All site-specific plan development and implementation will be approved by the local village Shura (Community Development Council or CDC). A CDC will be started if none exists in the candidate areas.

Compromises and accommodations for the plan will be up to the CDC and village. They are the most familiar with options, in particular grazing area changes, plowing restrictions, and pistachio harvest methods. The Forest and

Range Department staff will be available for help with governmental regulations or information.

The local CDC will be designated as the payment agency for local labor. They will recommend a group of individuals for labor and guard positions, and the Forest and Range Department will make the selection to help assure the candidates are the best suited for the positions. The Afghan Conservation Corps (with the Forest and Range Department) will be used as the funding and supervisory agency.

Since the local CDC is responsible for the plans and implementation, it is also authorized to enforce the management rules. Penalties and fines return to the local CDC.

### Protection and Watershed Improvement

Previous reports (Grauke and Shovic, Grauke, 2005) have emphasized the critical importance of reducing grazing to promote natural forest regeneration, increase ground-cover to reduce erosion and decrease overland flow, and increase bio-diversity (through re-development of natural assemblages of grass species and re-establishment of wildlife habitat)

Protection includes three parts: Closures, Area Protection, and Watershed Improvement.

- Closures – These are fenced-off plots in the recovery areas that exclude all grazing and other un-controlled harvest. They are up to 1 ha in size and are to be in locations representative of local conditions and visible to villagers. These will show villagers what is possible in terms of grass production, pistachio recovery, increase in bio-diversity, and can serve as demonstration plots for different kinds of management options, such as pistachio harvest timing, hay production, and increase in bio-diversity. They will also serve as experimental data for technical specialists in the Forest and Range Department to help justify and modify future projects.
- Area Protection – This includes the regular patrol of recovery areas and closures to enforce the local plan. Primary responsibilities are preventing grazing and tree-cutting. This will increase pistachio regeneration and assist in recovery of existing trees.
- Watershed Improvement – Check dams should be installed in areas where flooding and present gully erosion is occurring. This will reduce flooding and decrease lower-slope soil erosion. Terraces may be installed in areas where active hillslope erosion is occurring and check dams are at risk or gullies are forming due to excessive slope wash. Terraces should NOT be used in any large-scale way on hillslopes unless associated with planting pits as recommended in previous reports. This is because their need has not been demonstrated. The return of plant cover with the cessation or management of grazing will do much more for erosion reduction.

## Pistachio Recruitment

Field observations indicate there is re-sprouting of pistachio trees in these areas. This should be encouraged, because of local seedlings' genetic adaptation and probability of increase with protection from grazing.

Previous reports (ibid.) have emphasized the success potential for planting pistachio seeds (using local seed sources). It is recommended here because some areas have little or no natural pistachio seed sources and to increase rates of pistachio recovery over natural re-seeding where remnant trees exist. This will be a mix of inter-planting in existing protected woodlands to increase density, and planting in protected cut-over areas.

Seeding should follow previously-established guidelines (ibid.) with construction of water – conserving terraces and seeding pits (Figure T). Irrigation is recommended for maximum seedling survival. However, because remnant pistachio populations are concentrated on higher, less accessible lands none of the recovery areas have sufficient available water for irrigation. A higher density of seeding pits should be used to cover anticipated losses.

Figure T. Recommended Seeding Practice



## Recovery Area Descriptions

Each Recovery Area is about 5,000 ha in size but this may vary when detailed plans are made with the villagers (Figure Q and R). At least ten separate villages have been identified. There are smaller villages that may use parts of the pistachio forests. These will be surveyed during the project and added if they are interested in participation.

- Recovery Area A: Karasai

Elevations range from 1,300 to 1,800 meters in this area. Slopes range from 20 to 60 percent. The Karasai village is in this area, but there is also use by members of the Robatak villages for a total of 1,000 families. There are about 2,200 ha of remaining pistachio forests in this area and areas of erosion and flooding. No known Kuchi concentrations are in this area.

- Recovery Area B: Shorab

Elevations range from 1,200 to 1,600 meters in this area. Slopes range from 20 to 40 percent. Shorab and Sandqcha villages are in this area with at least 1,000 families. There is also use by the Robatak villages. Though there are no relatively dense pistachio forests in this area it held woodland populations in the past (picture). Grazing and plowing are common, but pistachios are re-sprouting from local isolated trees. It is also within 5 km of existing woodlands, so local seed is available. It is close to the Robatak Direct Seeding Project. No known Kuchi concentrations are in this area.

- Recovery Area C: Sari Kotal

Elevations range from 1,000 to 1,200 meters in this area. Slopes range from 10 to 40 percent. The Sari Kotal, Mang Qutan, Taikhonak, and Akhta Khana villages are in this area, but there is also use by members of the Sharikyar village for a total of 1,300 families. There are about 6,200 ha of remaining pistachio forests in this area. No known Kuchi concentrations are in this area.

#### Aspects of this Plan

- This is a conceptual plan. Detailed timelines and budgets still need to be developed, but the project should be implementable in 2006 and have multi-year parts.
- This project will fail if under-funded. Many of the benefits will only be realized after 2 – 5 years of application. Local education is critical, so Forest and Range Department staff must be made available and supplied with travel funds. Range management expertise should also be used.
- Monitoring and evaluation are essential for this plan. Forest and Range Department oversight should be continued through the Afghan Conservation Corps and other specialists in the Forest and Range Department.
- Some options for integrating grazing are collection of seed and re-planting of barren areas with a native mix, controlled hay-harvest with protection of emerging pistachio seedlings, and allowing controlled grazing in protected areas (possibly limited seasons where pistachio seedlings are not disturbed). The services of a Range Technician familiar with this kind of

environment is needed to participate in further development of these aspects.

- Potential conflicts with Kuchi (nomadic pastoralists) were avoided by using available data on wintering locations (Figure R where green circles are Kuchi encampments) and Afghan specialist reports on traveling routes. No conflicts between these Recovery Areas and the Kuchis were noted.

Deliverable # 4: A verbal presentation to the Department of Forest and Range staff, the Afghan Conservation Corps and USAID officials.

A Powerpoint presentation was made on Dec 3, 2005 to the Department of Forest and Range staff, the Afghan Conservation Corps at the Forestry Building. A verbal presentation was made on Friday Dec 2, 2005 to Dan Miller and other interested USAID individuals at the embassy. The Powerpoint presentation is included on the publication CD.

## Appendix A

### SCOPE OF WORK November 2005

**USDA TDY on “Conservation of Pistachio Woodland” under the “Biodiversity” area of USDA’s Participating Agency Service Agreement (PASA) with the U.S. Agency for International Development (USAID).**

#### **PASA technical assistance area:**

##### **Acting to Conserve Biological Diversity in Afghanistan**

USDA will provide technical advice and guidance for the relevant units of the Afghan Government in three main areas, 1) conservation of biologically important areas, 2) conservation of Afghan plant genetic and species diversity, and 3) building the Afghan Conservation Corps’ (ACC’s) capacity for increased and sustained conservation. (The Afghan Conservation Corps is a program of the Afghan Government, implemented by the UN Office For Project Services)

#### **Biodiversity conservation assistance sub-area:**

##### **Conservation of biologically important areas**

#### **Service to be provided:**

##### **Conservation of Pistachio Woodland**

The density of trees in Afghanistan’s unique and threatened pistachio woodland habitat was 40 to 100 trees per hectare in the early 1970s, but now is estimated to have dropped to 20 to 40 trees per hectare. USDA, with funding from USAID, has provided a grant to United Nations Office for Project Services (UNOPS)/Afghan Conservation Corps (ACC) for the labor and basic materials necessary for rehabilitation of pistachio woodland locations. The purpose of this TDY and others to follow is to provide the technical guidance necessary for the ACC to use its labor and other resources effectively to conserve pistachio woodland.

USDA will provide technical expertise to assist the ACC in utilizing good seed handling techniques for the regeneration of pistachio woodland, as well as expertise to control soil erosion prevalent in many pistachio woodland areas. ACC workers will collect and store seed, raise and plant seedlings, and work with the local community on soil and water conservation projects to stem the erosion affecting some pistachio woodland.

Desired result – improved conservation of Afghanistan’s Pistachio woodland ecosystem as evidenced by new protection against soil erosion, and successful planting of new trees.

## **TDY to provide service:**

### **Conservation of Pistachio woodland TDY#2**

USDA will field a technical specialist with ACC and Ministry of Agriculture, Animal Husbandry, and Food (MAAHF) to further develop a plan for rehabilitation of pistachio woodland locations selected by ACC with input from MAAHF. The plan will be informed by a map derived from satellite image analysis by the USDA technical specialist, and ground truth verification to be done by staff from ACC and MAAHF. This plan will include target communities who with ACC assistance will seek to initiate community management of their pistachio woodland. Locations in Samangan province will likely be include some of the first target locations.

This is a follow-up to TDY #1 of June 2005. TDY #1 included a flyover of Badghis province where significant amounts of pistachio woodland were viewed, even though a satellite image derived map produced by UNEP did not show woodland in that area. Dr. Henry Shovic, USDA Forest Service, who was part of the TDY #1 team and is returning for TDY #2, hypothesizes that the current relatively low density of pistachio woodland (due to cutting) has rendered the pistachio woodland spectral signature indistinguishable by Landsat from surrounding non-pistachio woodland, due to the relatively large pixel size of Landsat which does not allow fine resolution. Dr. Shovic thinks that analysis of SPOT satellite data with its finer resolution will more accurately show where existing pistachio woodland is located. More accurate maps of pistachio woodland can aid MAAHF/Dept. of Forest and Range and the ACC in planning rehabilitative activities such as tree planting and erosion control, and targeting communities to pilot community management of these woodlands.

### **Objectives:**

- 1) To present a satellite image-derived map of areas in Samangan and Badghis province to guide planning for rehabilitative work; to work with Afghan counterparts to integrate aerial flyover and ground truth verification (ground truth will be done by Afghan counterparts) in refinement of the map.
  
- 2) To review through discussions with ACC staff any new information regarding the status of pistachio woodland areas.
  
- 3) To undertake a flyover of pistachio woodland in Samangan province and possibly Takhar province for aerial visual assessment similar to that made for Badghis in June 2005. These flyovers will enable a comparison of pistachio woodland density among these provinces and help inform planning for rehabilitative activities.

4) To work with MAAHF and ACC to develop a conceptual plan for community management of pistachio woodlands with technical and labor support from the ACC, first focused on target communities where the ACC has already identified some interest.

**Deliverables:**

1. A map, on paper and on CD of pistachio woodlands in selected regions, as described in Objective #1.
2. A report on the results of activities under Objectives #2 and #3.
3. A conceptual plan, as described in Objective #4, for community management of pistachio woodlands with technical and labor support from the ACC, first focused on target communities where the ACC has already identified some interest. This plan should incorporate the technical recommendations and tasks in the reports by Grauke and Shovic in TDY#1.
4. An oral presentation to MAAHF/Dept. of Forest and Range staff, ACC staff, and USAID officials (Power Point) presenting the results of activities under all four objectives.

## Appendix B

### LITERATURE REVIEWED

UNEP (United Nations Environment Programme). 2003. Afghanistan Post-Conflict Environmental Assessment. United Nations Environment Programme. Box 30552, Nairobi, Kenya.

Grauke, L. J. 2005. Conservation of Pistachio Woodland – Report. USAID-Afghanistan, Office of Agriculture and Rural Development.

Grauke, L. J. and H. Shovic. Initiating Pistachio Woodland Rehabilitation in Afghanistan – Pistachio Woodlands TDY- 1: Report. USAID/Afghanistan, Office of Agriculture and Rural Development.

Olson, D. M. and E. Dinerstein. The Global 200: Priority ecoregions for global conservation. (PDF file) Annals of the Missouri Botanical Garden 89:125-126. as used in data supplied by: the World Wildlife Fund:  
<http://www.wwfus.org/science/data/terreco.cfm>

Kuchi Locations from The Vulnerability Analysis and Mapping Branch (VAM) of the United Nations: <http://82.205.204.77/geonetwork/srv/en/vamsie.main>

## Appendix C

Perspective View of the Samangan Sample Area – Satellite 2005 natural color

Source: Keyhole.com and Henry Shovic



## Appendix D

### Field Data Specifications Pistachio Rehabilitation for the Samangan Area, Afghanistan

Henry Shovic, Ismail Nasri  
USAID - USDA - PASA - ACC  
Nov 20, 2005

Purpose: 1) To get spatially explicit ground truth data for pistachio woodland inventory of Samangan area and 2) to characterize the Samangan area for pistachio woodlands

#### Field Location Requirements

- \* With GPS get a longitude/latitude/elevation for each field location.
- \* With Digital Camera make at least two photographs of each field location.
- \* Record digital camera photo numbers for each field location
- \* Include a name for the location.
- \* Mark the location on the field map with a number.

#### Kinds of Locations

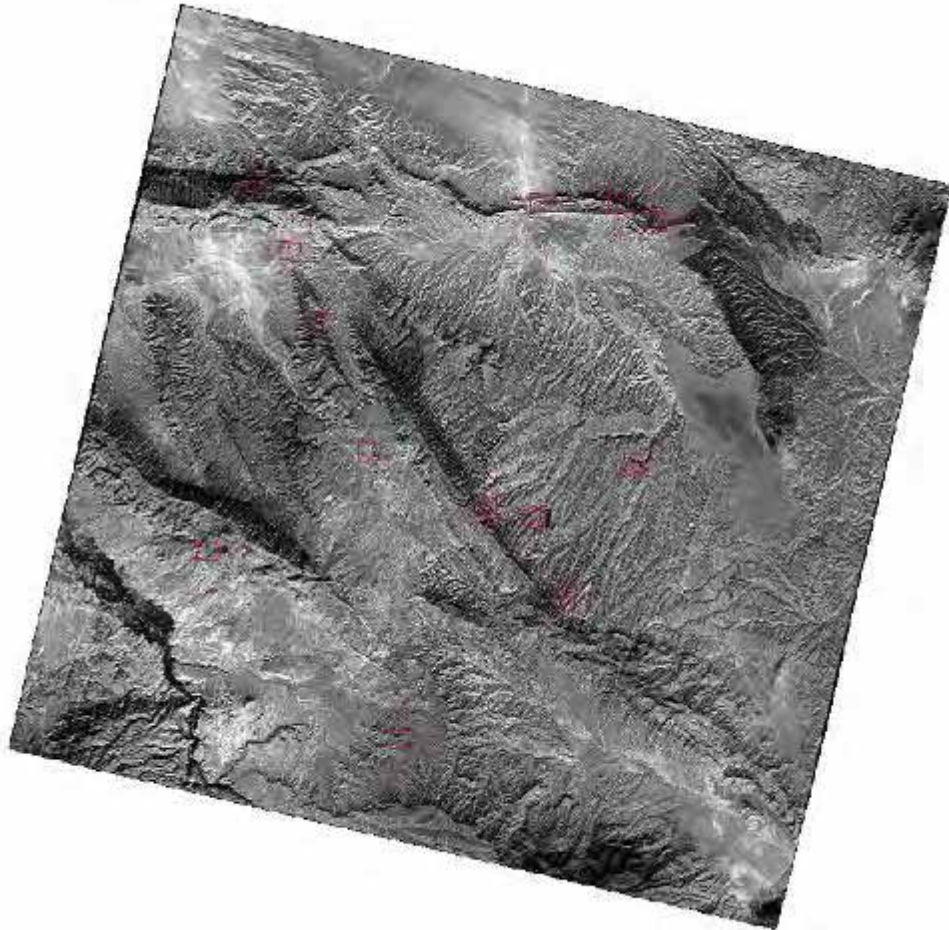
- \* Presence of pistachio (representative)
- \* Density of pistachio (measured at site with range finder)
- \* Cut over areas (estimate previous density) - show stumps
- \* Eroded areas in pistachio woodland
- \* Previously- rehabilitated pistachio area
- \* Villages that have potential for cooperation
- \* Heavily-grazed areas
- \* Recommended areas for seeding
- \* Recommended areas for protection

Other as needed

## Appendix E

### Training Areas Samangan Area Feature Analyst November 22, 2004

Location of Training Areas:



- 1  
Small trees, more texture than tree visibility, photos show trees
- 2  
Large trees, scattered
- 3  
Large trees very scattered clumps
- 4  
small trees

5

Large trees dense clumps

6

Medium trees, dense, low contrast

7

Small trees dense clumps

8

Large trees dense clumps

9

trees possible, not seen on image, photography shows pistachio is questionable

10

Photography shows trees, hard to see on image

11

large trees, low density

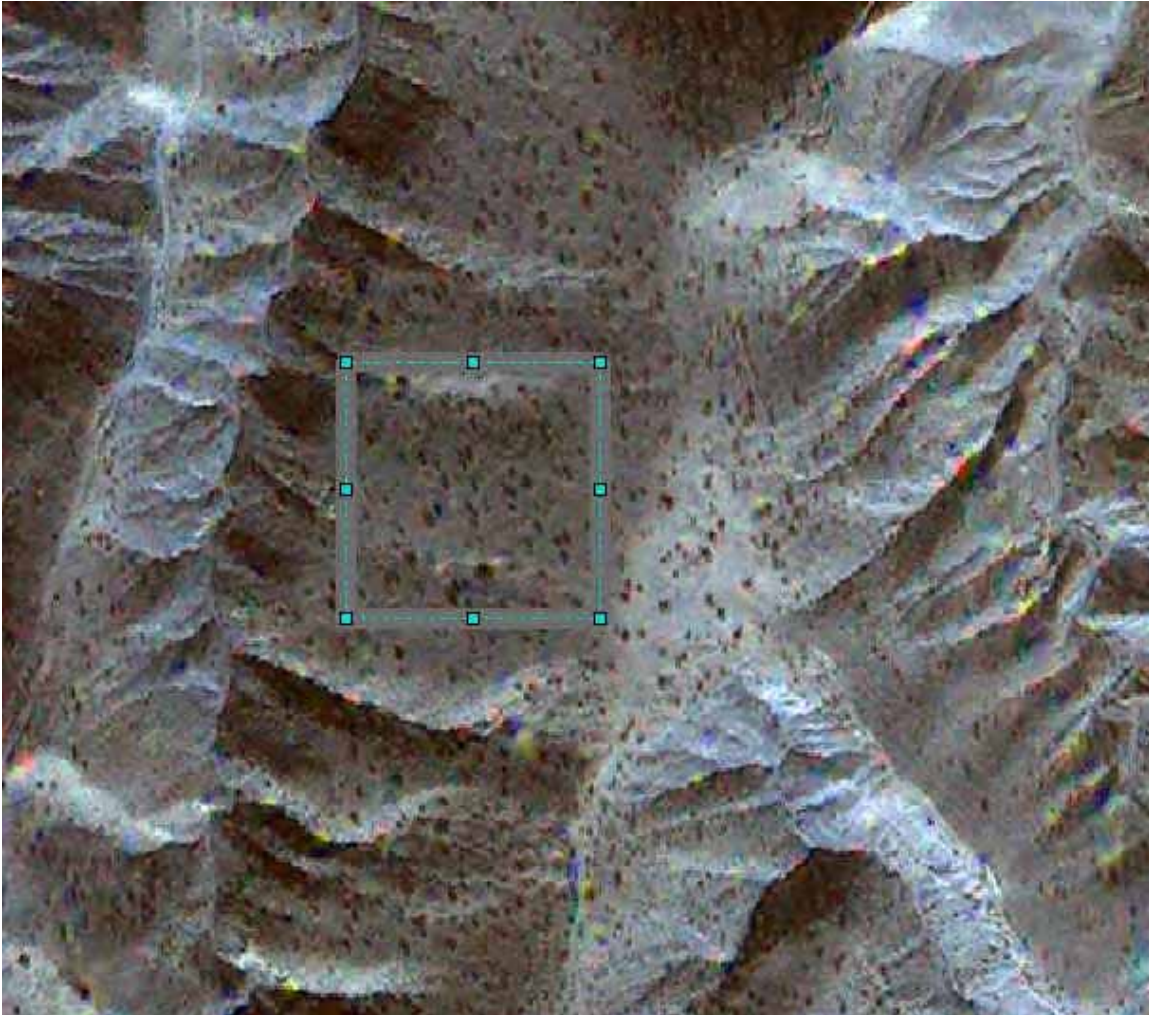
12

Small trees on ridgetops, texture only

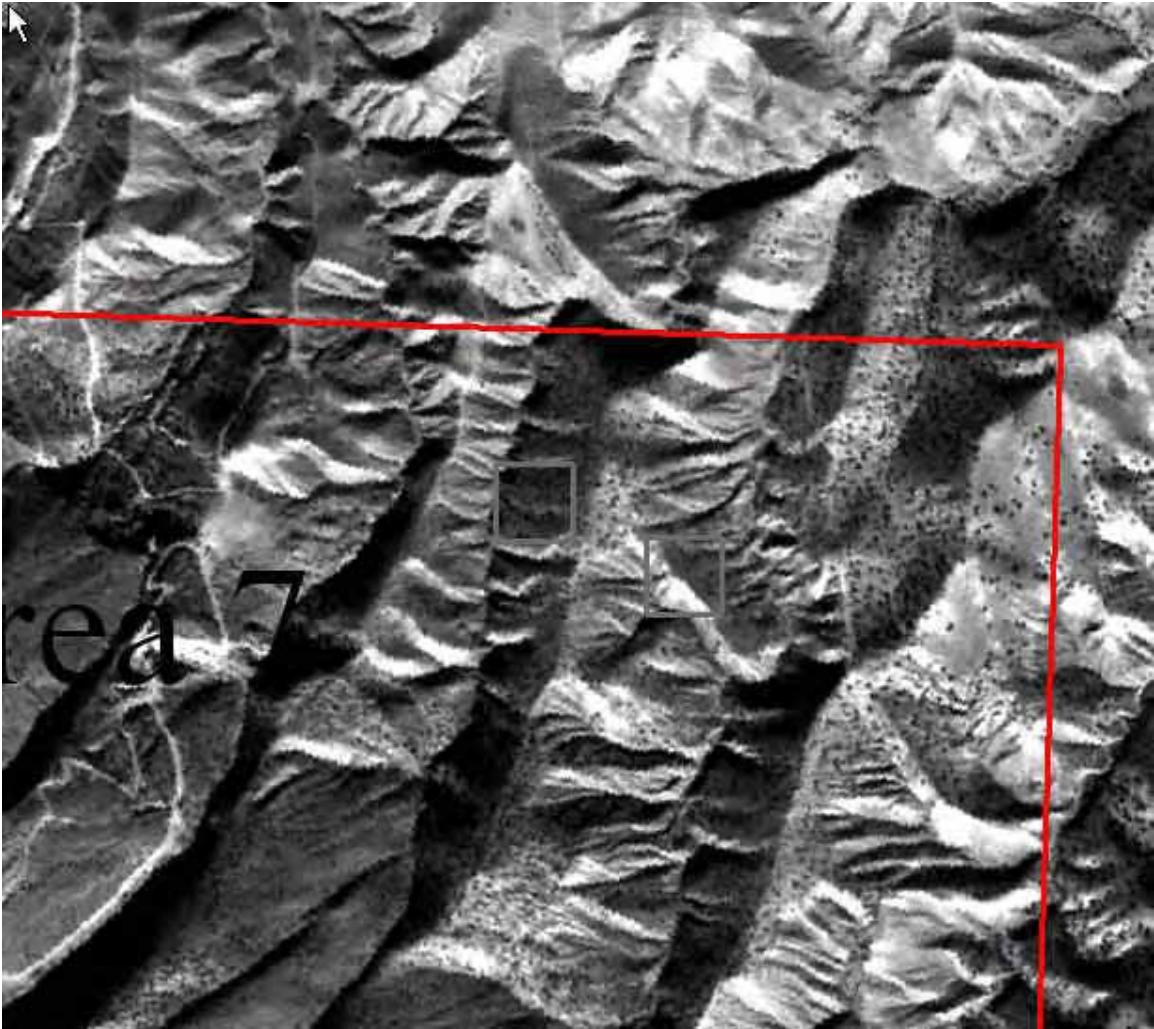
## Appendix F

**IKONOS satellite image at 1 m resolution compared with SPOT satellite image at 2.5 m resolution and LANDSAT satellite image at 30 m resolution compared with SPOT imagery.**

IKONOS at 1:3,000



SPOT imagery at 1:10,000 to compare to same area by IKONOS above. Upper left gray box is the same area as the above. Below 1:10,000 scale counts cannot be made on the SPOT image because of pixilation.



LANDSAT imagery at 1:10000.



SPOT imagery at 1:10,000 to in the same area to compare to LANDSAT above.

