Nursery Operations

Part 2

Principles of Effective Reforestation

2009

27b

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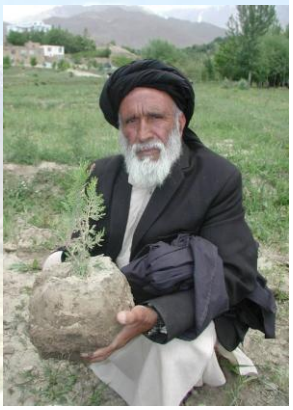
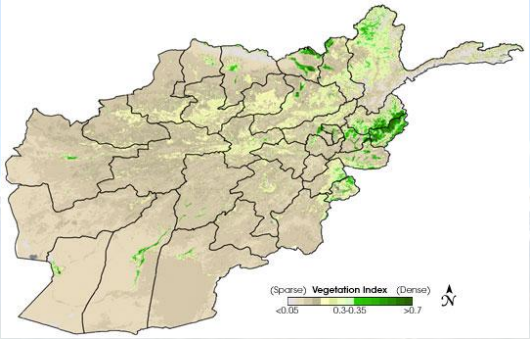
- What is effective reforestation
- Examples of effective reforestation in Afghanistan
- Steps for effective reforestation
- Incentives for reforestation in Afghanistan



Much of this material was prepared by Clark D. Fleege, Nursery Manager, Lucky Peak Nursery USDA Forest Service, Boise, Idaho 2007, 2008 and 2009

Definition of "Effective Reforestation"

1. Sustainable (healthy, long-term viability)
2. Meets desired goals and objectives



Components of "Effective Reforestation"

First part: Planning (one-third)
Second part: Execution (one-third)
Third part: Monitoring (one-third)

Examples of Effective Reforestation in Afghanistan
"Planting the Right Trees in the Right Places"

1. Kabul Greenbelt plantings (Tapi-Maranjan)
2. Cottonwood plantings in Logar
3. Pistashio plantings in Samangon

Steps For Effective Reforestation in Afghanistan

1. Clearly Stated Objective (Goal) of Planting

Why It's Important:

a. This becomes the "what"
b. "Desired Future Condition" is identified
c. "If you don't know where you are going, any road will get you there."
d. Must be attainable.
e. Must be "ecologically compatible" (Douglas-fir for Kabul Greenbelt is very poor choice)

Examples:

a. *Populus* pole production for houses
b. Re-establish natural woodlands for fruit production
c. Re-establish natural woodlands for wood production

Steps For Effective Reforestation in Afghanistan

2. Consultation/Community Involvement

Why It's Important:

a. This becomes the "who"
b. Understanding of need of the project
c. Increased participation (historical record, reduced destruction)
d. Potential for improved project through collaboration
e. Greater chance for longevity of project after project life

Examples:

a. Meet with community leaders on project acceptance
b. Meet with local farmers on local practices
c. Identify local expert or "champion"

Steps For Effective Reforestation in Afghanistan

3. Establish Standards and Guidelines

Why It's Important:

a. This becomes the "how"
b. These become the "roadmap"
c. These become the details; must be specific
d. The more complete the details, greater chance of success
e. Identifies weakness to strengthen

Examples:

a. What tree species to plant?
b. Where is the source?
c. Identifying the "target seedling" for the specific sites.
d. What is the site preparation prior to plantings? How? Who?
e. What is the post-planting care? How? Who?
f. Where will the funding come from? For how many years?
g. Provide training workshops to employees.
h. Seek out and retain skilled advisors.

Examples of Standards and Guidelines (Tools)

Seed Storage for Future Projects

Seed Orchard for Seedling Production

Examples of Standards and Guidelines (Tools)

Technical Seed and Nursery Workshops

Example of Standard and Guidelines: Target Seedling Concept
"Planting the Right Size Trees in the Right Places"

Rural Planting Sites

Urban Planting Sites

Steps For Effective Reforestation in Afghanistan

4. Monitor the Process and Results

Why It's Important?

a. Did we reach our destination?
b. Did we begin to accomplish our stated objective?
c. Did we follow the established standard and guidelines?
d. Does the community still support our joint project?
e. Could we improve our results with a change standards/guidelines?
f. Is this objective simply unobtainable; should it change?
g. Monitoring should occur all long the process, not just at the end.
h. It can cause the standards and guidelines to change during the process.

Examples:

a. Seedling survival surveys every first, third, fifth years.
b. Changes in technology from planning stage to implementation stage.
c. Are there standards/guidelines that could be changed to get same or improved result?

Sapling Handling at the Nursery

1. Limiting factor in tree growth and development is moisture;
2. Limit root exposure to sun/winds to 30 seconds;
3. Remove trees from nursery soils when soils are moist;
4. Use moist soil for packing roots for temporary storage;
5. Minimum root length should be 25 cm;
6. Keep roots out of direct sunlight (prevents drying);
7. Once trees are harvested from nursery, move quickly to temporary storage;
8. Trees should be dormant (not actively active) when harvested.
9. Trees must have adequate root mass when harvested.

Transporting Saplings to Planting Site

1. Protect trees' roots from drying (sun, wind) by covering;
2. Avoid damage to trees by rough handling;
3. Avoid contact of trees with petroleum;
4. Transport trees quickly to planting site;
5. Provide protection for seedlings at planting site.

Tree Planting

1. Harvest from nursery only enough trees for that day's planting;
2. Have an adequate sized crew;
3. Have the tools and supervision available;
4. Crew should receiving training in tree handling and planting prior to planting;
5. There must be adequate soil moisture before planting;
6. Select planting sites well before planting day; match tree species and sizes to the sites.

Site Preparation

1. Dig holes immediately prior to planting;
2. Must have adequate soil moisture at planting;
3. Avoid digging holes days prior to planting;
4. Pre-dug holes could be dry (too dry);
5. Pre-dug holes could be full of water (too wet);
6. Dig hole just large enough for root system;
7. If necessary remove weeds from planting hole prior to planting.

Hole Too Large for Root Mass

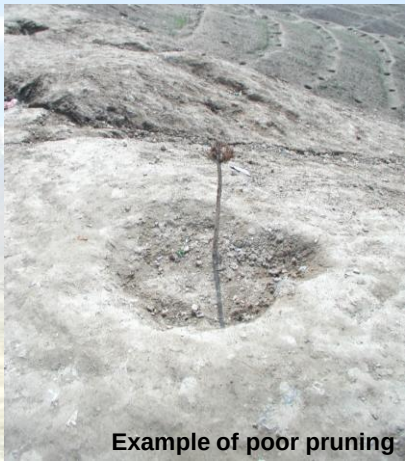
Planting Depth

1. Trees must be planted at the "root collar " (the same depth they grew in the nursery);
2. No roots must be exposed to sun and drying winds before planting;
3. Planting depth = that point where above-ground and below-ground meet;
4. Firmly pack loose soil around seedlings' roots (no air pockets);
5. Create shallow "bowl" (2 cm depth) for water collection.

Trees Planted Too Shallow; "Root Collar Exposed"

Pruning After Planting

1. Prune no more than 50% height of planted tree (2m height = 1m pruned);
2. Leaves produce food for tree;
3. Limited leaves = reduced food production for tree = greater chance of mortality.



Example of poor pruning

Poor Root Systems Are Tree Killers

1. Poorly developed root systems will restrict moisture update;
2. Fibrous roots are critical for moisture uptake;
3. Larger roots are critical for support;
4. Long roots absorb sub-surface soil moisture during dry periods;
5. Minimum root length for conifers 25 cm;
6. The larger the top of the conifer, the larger the root system needed;
7. Ideal conifer shoot/root ratio is 1/1.

Tree Mortality Caused by Poor Root Development; Trees Planted with Too Small Root Ball

Post-Planting Care: Irrigation

1. Helps eliminate air pockets after planting;
2. Keeps root zone moist;
3. Must be thorough watering;
4. Must be done every 2 weeks during first growing season.

Post-Planting Care: Protection

1. Protect saplings from human traffic;
2. Protect saplings from grazing;
3. Protect saplings from housing developments;
4. Protect tree with: fencing, guards, laws with penalties.

Sapling Planting Summary: Quality Control

Establish Minimum Standards

- Have planting plan before starting ("right tree in right place")
- Hole digging prior to planting (adequate soil moisture)
- Limit root exposure time (dry roots are dead roots; 30 sec)
- Proper planting depth (equal to "root collar")
- Irrigation (moisture limiting factor in tree growth; every 14 days)
- Pruning (leaves produce plant's food; ½ height of tree)
- Root length (anchor and "feeder"; minimum 25 cm)
- Shoot height (right-sized tree to location)
- Site selection (match kind of tree to location)

Provide Training Prior to Practice

- You demonstrate and explain
- They demonstrate and you explain
- They demonstrate and explain

Have the Right Tools

- Covered transport, shovels, tarps

Enforce the Standards

PLANTATION SUITABILITY INDEX FOR AFGHANISTAN

NAMES				SOILS					PRIMARY USES				MOISTURE	ELEVATION
Latin	Species	Common Name (English)	Common Name (Afghan)	No Site Limitations A	Drougthy and Infertile Soils B	Wet Soils C	Saline and Alkaline Soils D	Critical Soils E	Fuelwood Production	Lumber (wood) Production	Soil Stabilization	Watershed Rehabilitation	Minimum Annual Precipitation Requirement (mm)	Elevation Band (m)
Cedrus	deodara	Deodar cedar	Ilmanza	G	G	F	G	P	X	X	X	X	450	1800-2800
Thuja	orientalis	Arbor vitae	Morpan	G	G	P	F	P	X		X	X	450	1800-3000
Juniperus	excelsa	Greek juniper	Obakht	G	G	F	F	P	X		X	X	500	2000-3500
	seravschanica		Obakht	G	G	F	F	P	X		X	X	500	2000-3500
	semiglobosa		Obakht	G	G	F	F	P	X		X	X	500	2000-3500
Picea	morinda		Srup	G	F	F	P	P	X	X	X	X	500	2800-3400
Abies	webbiana		Bigur	G	F	F	P	P	X	X	X	X	500	2800-3400
Pinus	eldarica	Afghan pine	Najo Afghani	G	G	F	G	P	X	X	X	X	400	1600-2500
	halapensis	Aleppo pine	Najo	G	G	F	F	P	X	X	X	X	400	1600-2500
	wallichiana		Nishtar	G	F	F	G	P	X	X	X	X	400	2800-3400
	geraradiana	Jalgozeh pine	Jalghoza	G	G	P	F	P	X	X	X	X	400	1600-2000
	nigra	Austrian pine		G	G	P	F	P	X	X	X	X	400	1800-3000
Acer	negudo	boxelder	Gulbarg	G	F	F	F	P	X		X	X	350	2000-2500
Ulmus	pumila	elm	Pashakhana	G	F	F	G	P	X		X	X	350	1500-2500
Fraxinus	floribunda	ash	Shing	G	F	F	F	P	X	X	X	X	350	1800-2800
Ailanthus	altissima		Bidrosi	G	G	P	F	P	X		X	X	250	500-3000
Haloxylon	persicum	white saksaul	Saksaul	G	G	P	F	P	X		X	X	100	100-300
Eleangus	angustifolia	russian-olive	Sinjid	G	G	G	G	P	X		X	X	250	1500-2800
Morus	serrata	mulberry	Tut	G	F	F	F	P	X	X	X	X	300	100-3000
Prunus	armeniaca	apricot	Zardalu	G	G	F	F	P	X		X	X	300	1500-2800
Prunus	brahuica	apricot	Zardalu	G	G	F	F	P	X		X	X	300	1500-2800
Prunus	persica	apricot	Zardalu	G	G	F	F	P	X		X	X	300	1500-2800
Quercus	baloot	oak	baloot	G	F	F	F	P	X	X	X	X	400	1200-2800
Quercus	semicarpifolia	oak	baloot	G	F	F	F	P	X	X	X	X	500	2800-3200
Quercus	dilatata	oak	baloot	G	F	F	F	P	X	X	X	X	450	1800-2800
Pistachio	vera	pistachio	Pista	G	G	P	F	P	X		X	X	300	600-1800
Juglans	regia	walnut	Charmaghz	G	F	F	F	P	X	X	X	X	400	1800-2800
Eucalyptus	camaldulensis	eucalyptus	eucalyptus	G	G	F	F	P	X	X	X	X	150	100-900
Amygdalis	brahuica	almond	badam	G	G	F	F	P	X	X	X	X	250	1500-2800
Cercis	griffithii	redbud	Arghawan	G	G	F	F	P	X		X	X	200	300-900
Robinia	pseudoacacia	black locust	Acaci	G	G	F	F	P	X		X	X	150	200-2800
Gleditsia	triocanthus	honeylocust	Acaci khardar	G	G	F	F	P	X		X	X	150	200-2500
Populus	deltoides	cottonwood	Chinar deltoides	G	F	G	F	P	X	X	X	X	700	300-900
Populus	nigra	cottonwood	Arar	G	F	G	F	P	X	X	X	X	700	1800-2800

G = Good potential for Tree Growth and Development
F = Fair potential for Tree Growth and Development
P = Poor potential for Tree Growth and Development

Soils Group A = Soil properties that do not limit the choice of species. Soils are deep to very deep, moderately well to drained, moderately rapid to moderately slow permeability in the root zone; pH < 8.4
Soils Group B = Drougthy and infertile soils limit species selections. Soils over 50 cm deep, excessively drained, with less than 8 cm of available water capacity in the root zone, and have low inherent fertility.
Soils Group C = Wetness limits the choice of species. These soils may be permanently wet or consist of soils that are somewhat poorly drained to poorly drained during the growing season.
Soils Group D = Salinity or alkalinity limits the choice of species. These soils are modeately to strongly saline and/or alkaline; pH is greater than 8.4.
Soils Group E = The soils in this group are poorly suited for productive tree plantations. All have one or more characteristic that is highly critical for planting, survival, vigor and growth of trees and shrubs.
Soils Group E = Included are soils which are shallow to bedrock, shallow to gravel, very saline, very alkaline, stony, rocky, clayey with dense compact subsoils or very wet.
Soils Group E = Plant only those tree species wich have the best potential to survive and grow; an on-site investigation is necessary for these soils.


Increasing Need for Wood Products


Remember: Afghanistan's Forests = Water

Incentives needed to pay for the following:

1. The planting stock
2. The land to be planted
3. The labor to install the plants
4. The maintenance required to keep the plants alive
5. The protection of the reforestation

Without all 5 being addressed, a reforestation effort may fail

Type of incentives depend on the type or purpose of the planting

A 2008 and 2009 "Forestry Partners" meeting was held in Kabul. Discussion included this issue.

"Forestry Partners Workshop" on behalf of USAID Afghanistan's Alternative Development and Agriculture Office (ADAG) held in Kabul, Afghanistan (2008 and 2009). This effort was in support of the Participating Agency Service Agreement (PASA) PASA component, "Biodiversity Conservation and Natural Resource Management" with USAID/Afghanistan. It was part of a larger technical assistance mission to provide capacity-strengthening training to Afghan government institutions.

The issue of what is an appropriate incentive relates to:

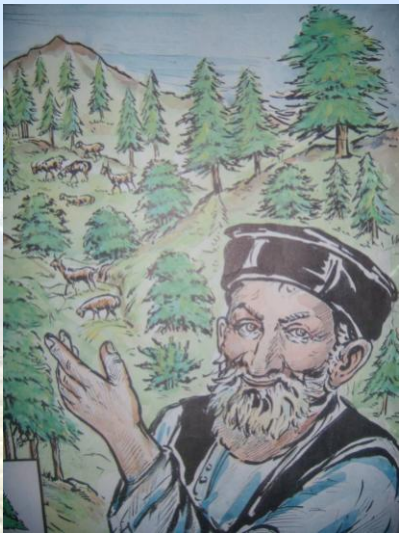
- **Purpose of planting**
- **Location of reforestation effort**
- **Soil and water issues**
- **Source of planting stock and materials**
- **Legal protections**
- **Technical capabilities**
- **Funding capabilities**
- **Governmental capabilities**

Many reasons for planting

The reasons behind planting are often linked to the incentives used to compensate people for the work

- Fruit
- Timber
- Firewood
- Soil Erosion
- Windbreak
- Riparian
- Beautification
- Biodiversity
- Picnic areas
- Wildlife
- Landslides and avalanche
- Education
- Non timber – medicines
- And more!

Some of these directly benefit the person doing the labor and some of these purposes benefit society as a whole and many benefit both



Reforestation in many different areas

- **Home compounds**
- **Public Green Areas**
- **Marginal Lands**

Many different types of incentives

- **Direct Payments**
- **Food for work**
- **The job that they have**
- **Gifts of planting stock**
- **Half price planting stock**
- **Tools**
- **Intercropping plants**
- **Training and expertise**
- **Protection of their land**
- **Improvements to their environment**
- **Civic pride**
- **etc**

1 - The payment is **immediate**

2 - The payoff is **deferred**. It can be larger than 1 but it is over time

Many variants of two themes

In general, the workgroup noted:

- Deferred incentives produce a better reforestation effort.
- Compensation over time results in the local population caring more for the plants.
- **BUT**, deferred incentives require creativity and can be difficult to effectively implement.
- Immediate compensation is easier to implement but requires continued funds to support maintenance and protection efforts.

All of these incentives can work well in some situations and poorly in other situations. Many specific lessons that have been learned in various reforestation efforts were discussed by the group.

- Direct Payments
- Food for work
- The job that they have
- Gifts of planting stock
- Half price planting stock
- Tools
- Intercropping plants
- Training and expertise
- Protection of their land
- Improvements to their environment
- Civic pride
- etc

Example: Planting stock that is given away is not valued by the recipient and not maintained. Recipient should pay something (labor, trade, money) for planting stock so that they will maintain and protect the plantings.

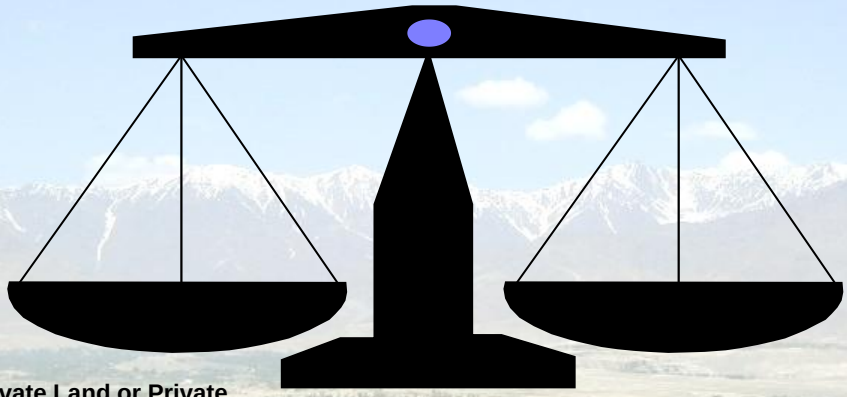
Example: It is critical to be very selective in choosing the recipient of reforestation assistance where the incentive is over time. They need to be able to appreciate long deferred benefits for immediate work.

Example: Plantings that take a while to produce a benefit for the local population can be augmented with intercropping that produces a more immediate payoff for the people's maintenance and protection efforts

The key issue in selecting any incentive or incentive combination: Does the person doing the work to install and maintain the planting see a benefit over time?

If the people can not expect to be able to enjoyed deferred benefits, the incentive needs to be immediate

The key is ownership



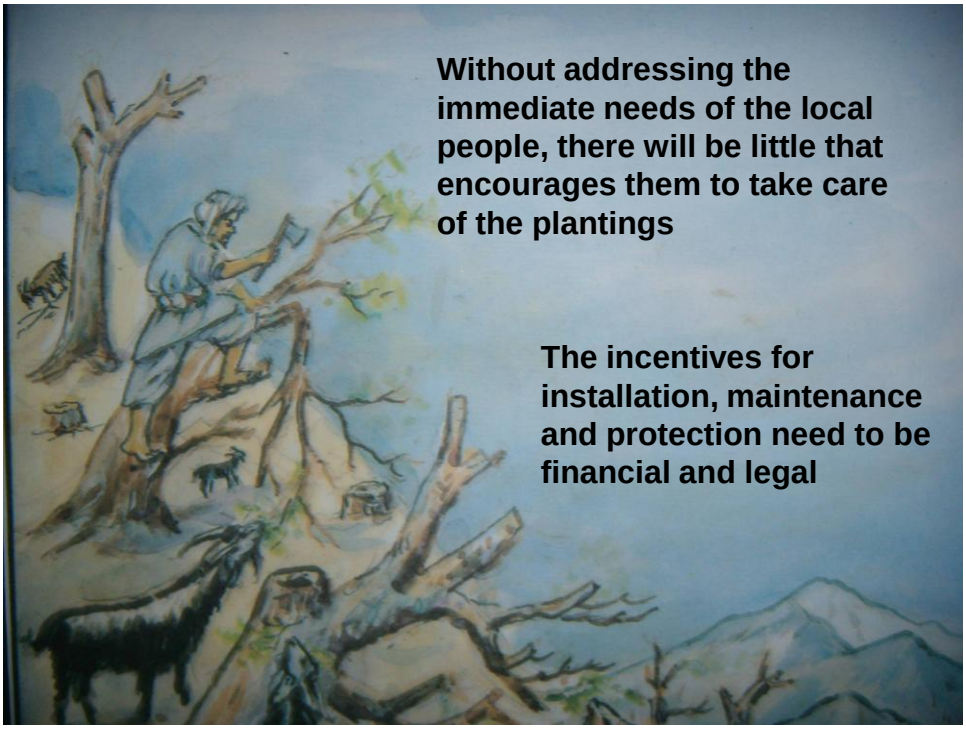
•Private Land or Private Control
•Local people can benefit and control use of plantings

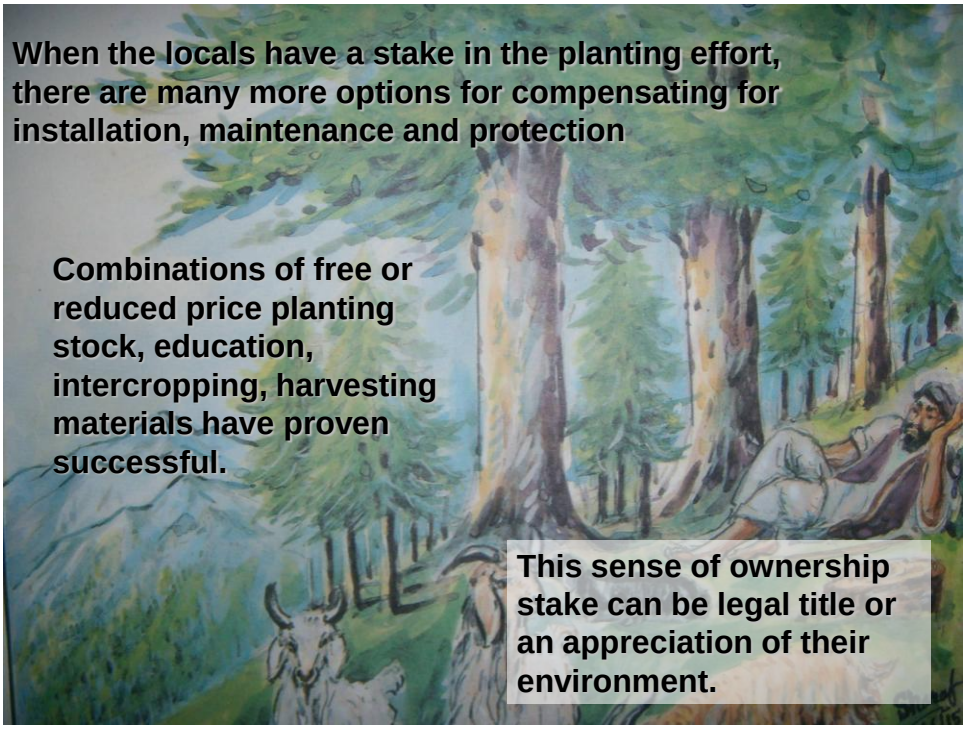
•Public Land
•Unofficial benefit?
•No legally recognized benefit for the local people

The 2008 and 2009 forestry workgroups had extensive discussion about how incentives and ownership of the resource are related

The question of who owns and controls the land affects many important aspects of reforestation

- **Who pays for the plants**
- **Compensation for installation**
- **Maintenance**
- **Protection**
- **Village based management**


Without addressing the immediate needs of the local people, there will be little that encourages them to take care of the plantings
The incentives for installation, maintenance and protection need to be financial and legal


When the locals have a stake in the planting effort, there are many more options for compensating for installation, maintenance and protection
Combinations of free or reduced price planting stock, education, intercropping, harvesting materials have proven successful.
This sense of ownership stake can be legal title or an appreciation of their environment.

Examples of incentives that are useful when the land is privately owned or controlled

- Incentives for purchase of planting stock
- Incentives for maintenance
- Incentives for protection

Representative from Roots of Peace discussed using half price orchard stock, intercropping, tools, and donated wood lot stock as an incentive

Examples of incentives that are useful when the land is publicly owned

- Incentives for purchase of planting stock
- Incentives for maintenance
- Incentives for protection

Representative from ACC discussed using cash payments as an incentive


وزارت زراعت مالداری ومواد غذایی
ریاست عمومی جنگلات وعلف چرها
نهال شبه به طفل بوده
نیاز به حفاظت وپرورش دارد.
(USAID)