More than 30 per cent of the Earth's surface is dry or semi arid.

Upwards of 70% of this area is used for agriculture or pastoral activities. Land degradation is occurring over most of this area, and increasing.

Approximately 15 per cent of the world's population and 25 per cent of the total land area of the Earth is directly affected by land degradation and desertification.

Desertification... ... 
severely undermines sustainable economic growth,
limits food security
and exacerbates susceptibility to famine
which is often accompanied by large-scale movements of displaced people.

UN statistics suggest that the failure of marginally productive land to cope with population pressures, together with increasingly variable climate, may already have displaced 25 million people worldwide from their land.

The consequences of these pressures fall hardest on developing countries and remediation is requiring more constant, and more expensive support from the international donor community.
Less than 50 years ago, this area was heavily forested.

The same process is happening all over Africa.

319 million hectares of Africa are vulnerable to desertification hazards due to sand movement.
More than a quarter of the African continent is at present in the process of becoming useless for cultivation due to degradation.

Is this information relevant in your project?
37 million hectares of forest and woodlands in Africa are said to be disappearing each year.

More serious still is the gradual removal of trees in farms and pastures, which are crucial for protecting productive land from erosion.
How does one combat this problem? 
Will conventional methods suffice?

In parts of Africa, deforestation rates exceed planting rates by 30:1. Additionally, planting schemes rarely replace lost biodiversity, but concentrate on a few fast growing exotics.
Presently, we are trying to sweep back the sands of the Sahara with a hand broom and dustpan.

We are not and will not win, using conventional methods alone.
• There are many reforestation projects around the world.
• They are costly.
• Most will not be replicated by the community because of their large size and cost.
• In terms of impact - few have had an impact beyond the immediate project area.
Most forestry projects are unaware of the untapped forestry resources around them, or of anything but conventional reforestation approaches.

This ‘shrub’ is actually the sprouting stump of a tree which has been chopped down. Few forestry or agro-forestry projects take into account the tremendous potential of these existing resources. In fact, often the first task of forestry projects is to clear the ‘useless scrub’.
Farmer Managed Natural Regeneration is the practice of recognising, selecting and pruning stems which sprout from the stumps of felled trees.

First the mass of regrowth (previous slide) is reduced to 5 or so stems and each stem is pruned.

Once trimmed, the ‘bush’ might look like this.

After just one year the numerous stems are growing vigorously and straight. Ideally, one or two are harvested from the clump each year, always leaving new regrowth to replace them.
By year 4 - 5, the stem which has been left is of considerable size and is making a significant contribution to the environment and agricultural system.

FMNR is
✓ Cheap
✓ Rapid
✓ Provides quick/early returns
✓ Can be managed by individuals or groups, independently of the project and
✓ Enhances agricultural systems.
Both men and women, but especially women should be included in this activity particularly if they own the means of production - the land and the trees; or at the very least have control over the proceeds.

If they farm this land, managing trees in this manner does not increase their work load significantly.

Women usually have the job of collecting firewood.

FMNR can work to their advantage in that wood becomes more readily available and they can earn money by selling surplus wood.

Cash earned by women is more likely to be spent on nutrition and education of children.
Trees have multiple benefits.

Army worms devastate millions of hectares of crops in Africa annually. This is a growing problem associated with the loss of trees, and hence habitat for natural predators.

Owls
Spiders
Preying mantises
Frogs
Insect eating birds
Lizards

... All need habitat in order to stay in an area. When encouraged and protected, their economic and ecological benefits run in the millions of dollars.

FMNR provides habitat for natural pest predators.
Trees provide fodder to livestock - pods and leaves.

Farmland with trees will attract more animals during the dry season than bare land. Animals will fertilise the soil while visiting.

How many livestock projects perform poorly because of inadequate animal nutrition?
Trees contribute to prosperity and food security directly.

These storage structures were made with locally grown wood from FMNR land.
In practically every developing country, wood has a ready market. Trees managed sustainably make economic sense to a farmer. In many areas, potential income from trees is greater than actual income from crops.
While selling fire wood is helpful, when farmers ‘add value’ to their tree products, their incomes increase even more.

Trees can provide the raw materials needed to kick start micro enterprise development.
Mulching soils in hot climates generally leads to great yield increases.

Usually it is not possible because families need to re-use the crop stubble for fodder or fuel.

By leaving trees in fields, farmers have an alternative source of firewood and fodder, enabling them to leave crop residue in the fields.
Most farmers wrongly believe that trees and crops are in-compatible.

With a certain balance, crop yields can actually increase and the trees can also provide additional benefit of various products and services.
Is this relevant to your communities and projects?
Farmer Managed Natural Regeneration

How Natural Regeneration works

On cleared land where live native tree stumps have not been uprooted, an extensive “hidden forest” already exists. Each year, these stumps sprout multiple shoots. It is traditional farming practice to slash and burn all re-growth in preparation for sowing the next seasons’ crop. Thus, the “bushes” never grow beyond 1- 1.5 meters tall. Consequently, depending on the time elapsed since the last slashing, the land ranges from being totally barren to being covered with varying degrees of bushy regrowth. It is referred to as an hidden forest because most of the time it is not seen or appreciated. With culling and pruning, selected stems from this regrowth grow rapidly.

Benefits of FMNR

'How to' Guide to FMNR

Constraints to Consider

Hidden Treasure -- On a FMNR consultation (see Part 2)

FMNR Workshop checklist – a tool (see Part 2)
Farmer Managed Natural Regeneration: **Benefits**

**Farmer Managed Food Security**

**Benefits**

As more and more farmers in the Maradi district started leaving trees on their land, they began to realize significant benefits. Today there are over two million trees being left at any one time by many thousands of farmers.

**Benefits to People.**

**FMNR contributes directly to human nutrition.**

Many regenerated species (Strychnos spinosa, Balanites aegyptiaca, Boscia senegalensis, Ziziphus spp, Annona senegalensis, Poupartia birrea, provide edible leaves and fruits for humans. Some are famine foods, some are eaten any time. Both benefit people. In recent years, fruits and leaves from stands of protected trees have been the only thing keeping some communities from starvation.

**FMNR contributes significantly to the local economy.**

From the first year of practising FMNR light fire wood is collected from trimmings. From the second year on, cut branches are thick enough to sell. From the first year of practising FMNR, it was conservatively estimated that US$ 600,000 worth of wood was sold as a result of practising FMNR in Maradi (1994-1997 MIDP Summary Report). Increasingly, value added products are bringing in additional income. None of this was possible before FMNR was introduced.

**FMNR alleviates firewood and building timber shortages.**

Whereas pre FMNR, one was hard pressed to find a properly fenced home compound or a new grain silo, farmers now have ample wood for construction. From the first year of practising FMNR, prunings provide light fire wood for cooking fires. No longer do women have to waste hours going further and further in search of firewood. Also, by not burning crop residues and animal manure, organic matter is now available to return to the nutrient poor soils. Farmers have even gone beyond just meeting domestic needs. Bush markets, where wood is sold, have opened up and people’s incomes have increased. FMNR has even had an effect on rural exodus as people have not needed to leave home in search of work or food as often. A small cottage industry is growing as more innovative farmers sell ‘value added’ wood products, such as hut roofs, tool handles and kitchen utensils.

**FMNR contributes to the quality of life.**

It could be argued that quality of life has also improved tremendously. A brief visit to an area cleared of trees reveals the non monetary benefits of FMNR. Strong, dust laden winds make life difficult at best and miserable at worst. In areas where FMNR is practised, wind speeds and dust load are greatly reduced. Even finding shade was difficult before FMNR was introduced. The country side is much more relaxing and pleasing to the eye because of FMNR. Because there is much more fodder and browse available for livestock, the potential for conflict between nomadic herders and sedentary farmers over scarce resources is reduced.

**Benefits to Livestock.**

**FMNR contributes to animal nutrition.**

Many trees produce edible leaves and pods which are eagerly sought out by livestock. FMNR has contributed significantly to livestock nutrition to the extent that it is now uncommon for animals to be in poor body condition during the long dry season. Working oxen are in better condition and are stronger at the start of the rainy season. Farmers who have left a lot of trees, especially Faidherbia albida, have pods for their animals to eat as well as a surplus to sell in the market.

**FMNR enhances animal health and survival rate.**

There is lower mortality and morbidity of suckling young as their lactating mothers have more milk.

**FMNR reduces animal stress.**

Stock use less energy obtaining food since there are shorter distances to travel in search of food. Stock also suffer less heat stress because of the presence of shade in the fields.
Benefits to crops.

*FMNR contributes to increased crop yields:* Trees provide shading for crops, protect them from winds, which may exceed 70 kph, reduce evaporation and enrich the soil through recycling of nutrients from foliage, flowers, fruits and twigs. Dust depositions on the leaves and droppings of birds attracted to the trees can also be significant (Buerkert & Hiernaux, 1998). Where there is no shading, soil temperatures can easily exceed 60° C. These high temperatures enhance evaporation and make it difficult for emerging crop seedlings to thrive. Soil fertility is increased because animals spend more time in the fields seeking shade and food, manuring the fields in the process.

*FMNR makes mulching crop land possible.* In the past, every stalk of straw was taken off the fields for use in cooking fires or for animal fodder. Limited availability of crop residues due to multiple competitive uses and increased labour demands at weeding were farmers’ major constraints to the broadcast application of crop residues and other organic material as surface mulch (Buerkert & Hiernaux, 1998). Large increases in crop yields have been recorded with surface application of crop residues on acid Sahelian soils. Animals now benefit from the tree pods, enabling farmers to leave the crop residue on the fields for mulching, as opposed to storing it as animal fodder. Mulching was not practiced before FMNR was introduced.

Benefits to the environment.

*FMNR increases bio-diversity and reduces dependence on pesticides.* Indigenous wildlife, including rabbits and guinea fowl is returning to the area. One site saw monkeys return for the fruiting season of certain trees after a 15-year absence. Pre FMNR a sighting of anything larger than a monitor lizard was extremely rare. Insect predators such as birds, lizards and certain insects (preying mantis, wasp’s etc) find shelter and places to breed in trees. These contribute directly to crop yields by reducing pest populations. Pre FMNR there were virtually no natural pest predators due to the absence of suitable habitats. As FMNR gained popularity rare plant species also began making a comeback.

*FMNR contributes to land reclamation.* When prunings and firewood cut from trees are placed on hardpan sites, the land can be restored to productivity. Firstly, termites seeking the leaves and wood, borrow up through the hard crust, enabling air and moisture to penetrate. When they eat the leaves, nutrients are returned to the soil in their droppings. Secondly, wind passing over the wood drops silt on the site, building up top soil. Hundreds of hectares of formerly useless land have been restored by this method. It must be noted that organic matter from branches and crop residues, was virtually non existent or not available for this type of restoration before the advent of FMNR.

Recommendations – Because of its low cost, ease of adoption, rapid results and multiple benefits, applicability of FMNR should be promoted in as many regions as is practicable. Before promoting FMNR, a). an assessment should be made of the suitability of the target area. The assessment should include a survey of
- presence of coppicing tree stumps
- firewood and timber needs in the area (source, cost, availability..)
- problems of farmers and herders which can be related to loss of trees (e.g. increased susceptibility to drought, increased incidence of pests in crops, increased poverty….)
- market demand for wood and other tree products (e.g. foods, fodder, medicines etc.)

b). Participatory rural appraisal with all stake holders should be conducted to determine needs and allow the community to understand and express their views on the root causes of their problems.
   c). A joint action plan should be developed.
1. The basics of FMNR.

FMNR depends on the existence of living tree stumps in the fields to be re-vegetated. New stems which can be selected and pruned for improved growth sprout from these stumps. Standard practice has been for farmers to slash this valuable re-growth each year in preparation for planting crops.

With a little thought and attention, this wasted growth can be turned into a valuable resource, without jeopardizing, but in fact, enhancing crop yields. Here, all stalks except one have been cut from the stump. Side branches have been pruned half way up the stem. This single stem will be left to grow into a valuable pole.

The problem with this system is that when the stem is harvested, there will be nothing else to harvest for some time.

Much more can be gained by selecting and pruning the best five or so stalks. The unwanted stems are removed. In this way, when a farmer wants wood he can cut the Stem(s) he wants and leave the rest to continue growing. These remaining stems will increase in size and value each year, and will continue to protect the environment and provide other useful materials and services such as fodder, humus, habitat for useful pest predators, protection from the wind and shade. Each time one stem is harvested, a younger stem is selected to replace it.
Dos and Don’ts.

There are very few basic rules to FMNR and in practice, each farmer adapts this system of agro-forestry to his own needs and situation. Different tree species may require different pruning techniques, something that can be determined by experimentation and observation.

1. Ideally a handsaw should be used for pruning side branches of young shoots. However, most farmers do not own a saw and they must use what they have on hand, usually an axe or machete. Simple rules of pruning are:
   - Always sharpen your axe / machete.
   - Always cut upwards carefully.

2. When cuts are made downwards, the tree can be easily damaged through splitting or the bark may be stripped from the stem. Excessive damage will set back the plants ability to re-grow and may become an entry point for disease and insects.

3. If the stems are pruned too high, they may easily be broken by livestock or even strong winds.

   Ideally, stems should be pruned up to half way up the trunk while small, and up to two thirds of the way up, once they are over two meters tall.
2. The Problem
The almost total destruction of trees and shrubs in Maradi district is a major problem with many consequences. Deforestation compounds the adverse effects on crops and livestock of recurring drought, high wind speeds and high temperatures, infertile soils and multiple pests and diseases. In turn, poverty and chronic and acute famine appear to be on the increase.

Root Causes of the Problem. Population increases in recent decades led to increased demand for firewood and building timber. Greater demand for farmland resulted in extensive clearing of remaining bushland. During the 1950’s and 60’s promotion of cash crops, (peanuts and black eyed bean) along with so called “modern” farming methods (requiring the total removal of all trees and stumps from fields) resulted in the removal of even more trees. Drought and continuous lopping of tree branches for browse also caused widespread death of trees. Farmers cut all tree re-growth (from buried stumps) to ground level each dry season, in preparation for planting annual crops. Destruction was almost total as formerly thickly forested land (as recently as only 30 years ago) become barren and degraded. Commercial exploitation of wood resources increased during the 1970’s – 80’s when rainfall declined significantly, forcing people to over exploit remaining trees in order to obtain money for purchasing food.

Effect of tree disappearance on people, their livestock, crops and the environment:

People - As wood became scarcer, women had to walk even further for fuel (basically small sticks & millet stalks), spending more time gathering poorer and poorer quality firewood and building materials. Failing this, cattle and even goat manure was used as fuel for cooking. Building material was extremely difficult to find. Building structures became more expensive, so lighter and less durable materials were used, or some structures were simply not built. Under cover of dark, people would dig up the roots of the few remaining protected trees, to use for construction. There were virtually no fences around homes. Grain silos were either in a state of disrepair or non-existent due to the scarcity of building materials. To buy poles, rural people had to travel up to 30 kilometres to the city market!

Livestock - In Niger, the dry season lasts approximately eight months. In the past, once grasses had dried up, animals largely relied on tree leaves and pods during the dry season. This important food source was lost along with the trees, resulting in livestock subsisting mainly on low food value crop residues. Subsequently, livestock condition and health status suffered. Working oxen were weak and in poor condition by the end of the dry season, when their strength was needed for ploughing. Lactating cows, ewes and goats had insufficient milk for their offspring. With the shortage of firewood, people began burning even the crop residues as fuel, further reducing the amount of fodder available for livestock. The loss of perennial vegetation in association with over grazing also paved the way for invasion of grazing lands by inedible weeds, leaving livestock with minimal rainy season grazing opportunities. Today, many thousands of hectares once covered in useful grass and tree/shrub species have been overrun by various inedible weeds (eg. Sida spp.).

Crops – Without protection from trees, crops were regularly buffeted by 60-70 Km/hour winds, and were stressed by higher temperatures, lower humidity, and sand blasting and burial during wind storms. A lack of trees also led to loss of habitat for natural pest predators such as insect eating birds (eg. Egrets), reptiles, amphibians and beneficial insects. Consequently, insect pest populations increased with devastating effects on crops. As the fuelwood shortage became more severe, women began cooking with animal manure, leaving less organic matter and nutrients to be returned to the land.

Environment – The environment has been greatly compromised by the loss of perennial cover, which was followed
by massive wind and water erosion. There has been a severe decline in bio-diversity. Water tables have dropped, springs have dried. The area of hard, compacted land has increased causing high water run off during intense rain storms and low infiltration. Along with the flora loss, much of the fauna has also disappeared.

3. How to address the problem

Farmer Managed Natural Regeneration (FMNR) – what it is and how it is practised.

The problem of loss of trees in the Maradi district was addressed through promotion of Farmer Managed Natural Regeneration. This is a method of agro-forestry in which naturally occurring re-growth (shoots) from the stumps of felled trees is managed by farmers. Each year, live tree stumps sprout multiple shoots. The traditional farming practise is to slash and burn all re-growth in preparation for sowing the next season’s crop. Because it is regularly cut, this re-growth never exceeds a height of 1 – 2.0 meters. Consequently, depending on the time elapsed since the last slashing, the land ranges from being totally barren straight after slashing, to being covered with bushy re-growth up to 2.0 meters tall. FMNR involves culling and pruning of selected stems from this re-growth. FMNR is not new, it is simply a form of coppicing and pollarding, which has a history of over 1000 years in Europe (Firewood crops, 1980). FMNR was new however to many farmers in Niger who traditionally viewed trees on farmland as “weeds” which needed to be eliminated because they compete with food crops.

There is no set system or hard and fast rules. Farmers are given guidelines but are free to choose the number of shoots per stump and per hectare that they leave, the time span between subsequent pruning and harvest of stems and the method of pruning.

The basic method of FMNR is very simple. The farmer selects the stumps he/she wants to leave and decides how many shoots are wanted per stump. Excess shoots are then cut and side branches trimmed to half way up the stems. A good farmer will return each 2 -6 months for touch up prunings and thereby stimulate faster growth rates.

As acceptance and understanding by farmers increased, the system of FMNR being promoted changed. There have been three main phases:

a) Modern Land Clearing (Sassabin Zamani)
Instead of clearing all tree re-growth on cropland, single stems were selected from about 40 stumps and pruned. Although modest, this was a big step for farmers who feared that the trees would not allow their food crops to grow well and who were initially ridiculed by their neighbours.

b) New – Modern Land Clearing. (Sassabin Sabon Tsare)
As people gained confidence with “modern clearing” and realised that there were many benefits in having trees in their fields, a more intensive form of FMNR was promoted. In this system, five stems were left per stump, with the intent of harvesting one stem each successive year, and allowing a new stem to replace it. For each year that a stem is left, it increases considerably in size and value. Stems on fifty to one hundred stumps per hectare were pruned in this way.

c) Every Stem is Profitable (Kowani Gindi Riba Ce)
A significant paradigm shift was occurring. Farmers ceased to see trees as weeds and began appreciating them as a cash crop in their own right. At this stage it was relatively easy to introduce a third modification. For a significant part of the eight month dry season in Niger, native woody vegetation continues to grow. Farmers were now challenged to leave and prune five stems on every stump growing on their land for the length of the dry season. Just prior to planting their crops they could then cut out all the stems that they did not want.
The stems respond to the culling and pruning by growing rapidly and providing small but useable stakes. Through this method, otherwise idle land becomes a productive resource during the dry season. This growth provides more browse, mulch, wind protection and deposition of wind borne silt and organic matter on the farm. Some species fix Nitrogen in the soil, and roots of many tree species have mycorhizal associations which concentrate scarce phosphorus in the root zone.

Farmer Managed Natural Regeneration: Constraints to Transferability

Presence of live tree stumps:

- FMNR depends on the presence of suckering tree stumps of species which can be regularly coppiced or pollarded and which provide useful wood. However, even land where the original trees have been removed has been restored by farmers who have broadcast seeds of desirable species in their fields. Seeds that germinate and grow to maturity are eventually managed in the same manner as regrowth from tree stumps used in FMNR.

Climate:

- In areas of low rainfall eg. below 200 mm, tree growth rates will be slower and the cutting rotation should be reduced accordingly. In these areas tree establishment by direct sowing of seed in the field will be less successful and take longer than in higher rainfall areas.

Cultural factors working against adoption include:

- Lack of respect for farm property. In Niger there is free access to farmland during the dry season and in the past farmers not only had no recourse if someone else cut their trees, it was considered anti social to complain about it. Consequently a “what’s the use of even trying” attitude prevailed.
- A setting where innovators and those who do things differently are discouraged and even ridiculed.
- Language may reflect deeply ingrained attitudes. eg. in Hausa the word for tree (itce) is the same as the word for fire wood. ie. Trees are given no intrinsic value of their own, apart from their utility for firewood.
- Historically, when soil fertility diminished, rural communities survived by moving to virgin bushland and clearing it. There is rightful pride in the pioneering spirit that accompanied land clearing and enabled farmers to feed their families. If not presented properly, FMNR may appear to attack a community’s pride in their forefather’s “taming of the land” and thus not be readily accepted.
- Cultural factors may work against adoption. Fulani cattle herders, who see their lifestyle as the best in the world find it humiliating to consider chopping wood and selling it the way Hausa tribesmen, their traditional enemies, do.
- Absence of consensus in the village or district. If only a minority are involved they may be discouraged by ridicule and stealing.
- Inappropriate government laws. If the farmer does not have the right to harvest the trees he has protected, there will be little incentive for him to do so.

Reasons successful adoption of FMNR in Maradi.

- There was a severe wood shortage.
- District wide exposure to and teaching of FMNR through a Food for Work Program and continued project
activities. People perhaps for the first time linked drought and famine with the disappearance of trees and saw that they were not only partly responsible, but it was within their means to do something about it.

- Farmers trusted MIDP staff.
- Farmers were effectively given ownership of the trees on their land. This point is of immense importance. If farmers had no guarantee that they would benefit from their labours it is very unlikely that they would bother practicing FMNR.
- A community based regulatory system developed. Cases of stealing were dealt with by the local chief and not a distant forestry agent. Farmers gained confidence that their rights would be respected and defended. Farmers began to take the un-cultural step of prosecuting offenders – even if related to them.
- FMNR is easy to implement and requires no investment to start.
- FMNR is profitable.
- The presence of trees in fields did not lower millet yields as feared and actually helped increase them. This factor is of utmost importance to poverty stricken farmers who regularly face hunger.
- FMNR effectively increased available fodder for livestock.
- FMNR did not depend on a project to spread to other areas, but spread from farmer to farmer by word of mouth.

**Questions for discussion groups or further study.**

- What are the advantages of FMNR over conventional reforestation techniques?
- How can farmers be encouraged to practice FMNR?
- How can FMNR be promoted amongst nomads who cannot protect their trees while travelling and who have no legal claim on land.
- How can the different needs of sedentary farmers and nomadic herders who use the same land base be dealt with when promoting FMNR?
- What are the essential ingredients needed for a community to adopt FMNR?
- Are there areas where FMNR cannot be practised?
- “A breakthrough may only come when farmers stop seeing trees in their fields as weeds, and start seeing them as a “cash crop” and valuable resource in their own right.” Do farmers in your region see trees as weeds? How do you plan to overcome this attitude?
- What existing laws either encourage or discourage a community or individual from adoption FMNR?

**Gaps in knowledge.**

There are many gaps in our knowledge of FMNR. In Maradi district, each individual farmer more or less adapted FMNR to his/her own personal needs. Decisions were affected by financial considerations, likelihood of trees being stolen, perceptions of FMNRs affect on crop yields, peer pressure etc. Investigation is needed into various aspects of FMNR (including – most beneficial spacing, species mix, age to harvest, type of harvesting...) for specific purposes. Recommendations will differ according to the primary purpose for practising FMNR, which may be as varied as environmental restoration, provision of economic security, enhancing livestock or crop production or maximizing wood production. Once the “most beneficial” method of practising FMNR is determined for a specific purpose, recommendations can be made to farmers who could then make informed decisions.

For each setting where FMNR will be promoted, legal and cultural considerations and historical relations between
stake holders need to be taken into account. The following points list some of the factors affecting FMNR adoption in Niger:

- A lack of respect for farm property prevailed. In Niger there is free access to farmland during the dry season and in the past farmers not only had no recourse if someone else cut their trees, it was considered anti social to complain about it. Consequently a “what's the use of even trying” attitude prevailed.
- Innovators and those who do things differently were discouraged and even ridiculed.
- Language may reflect deeply ingrained attitudes. eg. in Hausa the word for tree (itce) is the same as the word for fire wood. ie. Trees appear to have no intrinsic value of their own, apart from their utility for firewood.
- Historically, when soil fertility diminished, rural communities survived by moving to virgin bushland and clearing it. There is rightful pride in the pioneering spirit that accompanied land clearing and enabled farmers to feed their families. If not presented properly, FMNR will not be understood as it may appear to attack a community’s pride in their forefather’s “taming of the land” and thus not be readily accepted.
- Cultural factors may work against adoption. Traditionally, Fulani cattle herders saw their lifestyle as the best in the world. Initially they found it humiliating to consider harvesting and selling wood from FMNR, the way sedentary farmers, (their traditional enemies), did.
- Absence of consensus in the village or district. If only a minority are involved they may be discouraged by ridicule and or the stealing of their trees.
- Inappropriate government laws. If the farmer does not have the right to harvest the trees he has protected, there will be little incentive for him to do so.

Additional Information.
- The number of trees to be left in a field will depend on the number of stumps present and the farmer’s preferences. In practice (in Niger), each farmer adopted the system which best met his needs. Some left over 200 trees per hectare, others not even the recommended 40! The “correct” number of trees to be left will be a balance between farmers’ needs for wood and other products, optimal environmental protection and minimal negative effect on crop yields (maize, millet etc).
- The practice of FMNR depends on having living tree stumps in the fields to start with. Even this is not insurmountable as in many cases, farmers can successfully broadcast seeds of desirable species which once established, become the basis of a FMNR system.
- In areas of low rainfall e.g. below 150 - 200 mm, growth rates will be low, and harvest or cutting regime should be reduced accordingly. Also, in low rainfall areas, establishment of direct sown trees will take longer and be more difficult than in higher rainfall areas.
- In areas where existing species are predominately thorny, or they compete heavily with crop plants, FMNR may not be an option. Where existing species are palatable to livestock, practising FMNR is more difficult, as the increased effort required to herd animals or protect trees is beyond the reach of many farmers. In many cases however, the species are not palatable and there is no need to exclude animals from the field during the dry season.
- Where mechanized farming and use of draft animals is common, farmers may not want trees in their field. In such cases, farmers can be encouraged to try leaving trees in rows so as to minimize interference with machinery.
Farmer Managed Natural Regeneration

How Natural Regeneration works

On cleared land where live native tree stumps have not been uprooted, an extensive “hidden forest” already exists. Each year, these stumps sprout multiple shoots. It is traditional farming practice to slash and burn all re-growth in preparation for sowing the next seasons’ crop. Thus, the “bushes” never grow beyond 1-1.5 meters tall. Consequently, depending on the time elapsed since the last slashing, the land ranges from being totally barren to being covered with varying degrees of bushy regrowth. It is referred to as an hidden forest because most of the time it is not seen or appreciated. With culling and pruning, selected stems from this regrowth grow rapidly.

Benefits of FMNR (See Part 1)

’How to’ Guide to FMNR (See Part 1)

Constraints to consider (See Part 1)

Hidden Treasure -- On a FMNR consultation

FMNR Workshop checklist – a tool
“What is the hidden treasure of your district?” With this question, the workshop on Farmer Managed Natural Regeneration of trees commenced. The 25 delegates represented the government forestry and agriculture services, community leaders, men and women. They listened to a story about Yoseph, a story which many could identify with.

Yoseph was a poor farmer who was ashamed that his children had to beg for food and that he was too poor to send them to school. He was tired of being poor and sick of his farm which failed him year after year. So Yoseph sold his farm. He left his wife and children in the care of his brother, going off in search of treasure.

Yoseph travelled for several years to different countries. He suffered many hardships: He was robbed, he got ill, he was chased by the police and was often cheated. In the end, he found no treasure, and even the little that he had when he left home was all gone. So Yoseph decided to return to his home village. When he got there, he found that his wife, having got tired of waiting, had remarried and his children had left for the big city. Discouraged, he decided to visit his old farm. When he arrived, he found an electric fence around it. There were many workers digging and trucks coming and going. Where his hut had once been there was now a mansion. He went to enter, but the guard stopped him. So he asked, “how did the new owner of my farm become so rich?” The guard answered “he worked very hard ploughing the land. One day while ploughing, he saw something shiny. He picked it up and saw that it was gold! He kept digging and found more gold. As you can see, he is still digging!

Yoseph went back to the village and wept. Everything that he sought was now beyond his reach. Even what he had was now gone.

He had travelled the world looking for riches, but failed to see the riches at his feet.

If only his eyes were opened before he sold his farm!

There may be riches in your farm that you do not even know about. Ask God to open your eyes to the riches He has placed at your feet.

As the morning unfolded, the forestry extension agent explained how the area had been forested 30 years ago when people had been resettled there and the region was noted for its food security. Gradually the forests disappeared with clearing for farmland, lighting of bush fires and making charcoal. He went on to describe their forestry interventions: despite having 40 nurseries producing millions of seedlings per year, largely due to drought and livestock, there was a less than 30% survival rate. It was not lack of funds or skill or dedication that resulted in them losing the battle against deforestation. Their current practices simply weren’t a match for the harsh conditions.
Community leaders then shared how they were not stupid. They knew exactly what would happen if they cleared the forest. They valued the forest for its bounty of foods, fodder, wood and other materials. They also understood the relationship between both land degradation and declining rainfall and hunger with the decline of the forest. However, they explained that it was hunger that drove them to clear it. In order to feed their families in time of famine – they resorted to exploiting the only remaining resource left to them – the forest. And over time, they destroyed it. Today – they are still hungry and poor. Poorer than before because they no longer had the forest to fall back on.

These presentations were then followed by the description of a tree management system called Farmer Managed Natural Regeneration. FMNR in its simplest form is merely the selection and pruning of stems which sprout from tree stumps. Normally 10 – 20 stems sprout from a stump. By selecting approximately 5 stems per stump and pruning them, very rapid re-growth can be achieved. Each year one stem from each stump is harvested so as to never leave the area denuded. With each passing year, subsequent stems are larger and hence more valuable. In this way, community needs are met and the environment benefits enormously. FMNR is cheap, very rapid and accessible to the poorest of the poor. The process is like bringing an underground forest to the surface.
People then broke into groups which worked on questions such as – is FMNR feasible here? What are the obstacles? What steps should be taken next. Once the delegates understood the concept the response was spontaneous and unanimous. “We will try this system and we will teach our neighbours. “

The meeting then proceeded to a degraded forest, where all the trees had been chopped out, but there were millions of living stumps there just waiting for the right attention to become trees again.

A number of stems were thinned and pruned by each member of the group, and then some simple calculations were done. One young trunk was estimated to be worth 12cents in the market. In the immediate area around the group, there were probably 100 young trunks, so, the total value would be only $12.00. Still not terribly interesting. However, if the same trees were aloud to grow for 3 years, their value would be $2.50 each. Then we looked at the whole valley. There would easily be 1,000,000 trees there. One million trees at $2.50 each gives a total value of $2,500,000! Now, that’s interesting, especially since by their own confession, many delegates did not have even $1.00 to their name.

Each person went away on fire with enthusiasm. Many made a commitment to demonstrate this method on their own farm, and to teach their community.

For the first time, some began to grasp that there was indeed hidden treasure in the district!
Organising a Farmer Managed Natural Regeneration Workshop

Checklist of things to remember

Goal:
1. to introduce the concept of FMNR (benefits, why and how it is done...) to project staff, local farmers and the forestry service
2. to demonstrate methods of FMNR in the field.
3. to come to a common understanding between project staff, farmers and the forestry Dept. of the feasibility of FMNR in the region.
4. if the answer to 3. is positive, to produce a draft plan of action.

By the end of the workshop:
attendees will know what Farmer Managed Natural Regeneration is and will be able to practice it.
Project Staff, the forestry service and farmers will have decided if they are able and willing to practice FMNR.
Project staff, the forestry service and farmers will have produced a draft plan of action for implementing FMNR.

Format of Workshop
1. Participatory. The first session would invite farmers and forestry agents to give their views on the state of forestry as it stands (their perception of the problems, the level of tree cover in the past, the current level of tree cover, main causes of over exploitation, what the situation will be like 5, 10, 20 years into the future if things continue as they are now, what things they think should be done to rectify the situation......
This session would include individuals presenting their views to the group, focus groups with reporting back to the main group, ..other.

2. Input from workshop facilitator using overheads and examples from other countries (should not be too long: 1 to 1 1/2 hours max, and could be broken up to give people ample opportunity to ask questions)

3. Field visit and practice.
A site should be selected which has tree stumps which are sprouting new growth.
Participants would then have the opportunity to practice FMNR themselves.

4. Group discussions
On value & appropriateness of FMNR to their situation, discussion on constraints to implementing FMNR, preparation of draft plan of action.
5. Evaluation and wrap up.

**To Consider:**

**Number and position people to be invited -**
- From NGO ..........
- From the farming community (representatives of men, women, youth, herders, ..........
- From the forestry and agriculture departments.......... 
- From local government? .......... 

**People who will run the course and their roles:**
- Facilitator
- Facilitator (for discussions, focus groups, producing joint plan of action – 
- Translator
- Driver

**Duration**
One day. Two if follow through on workshop conclusions will be conducted.

**Venue**
Require suitable location for power point or overhead presentation and group discussions and accesability to field site.

**Meals**
Adequate and good food for the group.

**Cost**

**Materials**
Overhead projector or digital projector screen
Overheads
Butcher paper
Tools typical of what farmers use such as axes, saws, knives for pruning trees. The tools must be sharp and there must be enough of them for most delegates to be practicing at the same time. It may be good to request that delegates bring their own tool (s).

Transport to site

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Uncovering the Hidden Forest.
A Short History and Description of Farmer Managed Natural Regeneration.

Tony Rinaudo
2004

Introduction

For many years, conventional Western forestry methods have been applied, and exotic tree species promoted in Sahelian countries in order to combat desertification. Large and small projects were commissioned to curtail the assumed southward movement of the Sahara desert, but few made any lasting impression.

Little thought was given to the appropriateness of these methods. Indigenous species were generally dismissed as ‘useless’ scrub. In the name of afforestation, many projects even cleared the ‘useless scrub’ to make way for exotics. Often exotic species were simply planted in fields containing living and sprouting stumps of indigenous vegetation, the presence of which was barely acknowledged, let alone seen as important.

This was an enormous oversight. In fact, these living stumps constitute a vast ‘hidden forest’, just waiting for a little encouragement to grow and provide multiple benefits at little or no cost. These live stumps may produce between ten and fifty stems each. During the process of traditional land preparation, farmers treated these stems as weeds, slashing and burning them before sowing their food crops. Under this management system, the stems rarely grow beyond 1.5 meters tall before being slashed again. The net result is a barren landscape for much of the year with few mature trees remaining. To the casual observer, the land appears to be turning to desert and most would conclude that tree planting is required to restore it.

Farmer Managed Natural Regeneration (FMNR) is the systematic regeneration of this ‘hidden forest’.

Desired tree stumps are selected. For each stump, a decision is made as to how many stems will be chosen for growth. The tallest and straightest stems are selected and side branches removed to roughly half the height of the stem. The remaining stems are then culled. Returning regularly to prune any unwanted new stems and side branches attains best results.

Tentative steps to introduce FMNR commenced in 1983, in the Maradi Department of Niger Republic. Twenty-two years on, the results have been amazing with FMNR being practiced in one form or another across Niger and beyond.

A social, rather than a technical breakthrough has been achieved. The greatest barriers to reforestation were neither the absence of an exotic super tree nor ignorance of best practice nursery and tree husbandry techniques. The greatest barriers were the collective mindset which saw trees as ‘weeds’ needing to be cleared and inappropriate laws which put responsibility and ownership of trees in the hands of the government and not in the hands of the people.
With the aid of the Maradi Forestry Department, which unofficially relaxed laws on tree harvesting, farmers stopped seeing this tree re-growth as a weed problem. Trees had become a cash crop with multiple benefits. Once this was established, the revolution began, moving slowly but surely from farmer to farmer and eventually across the nation, often aided by various development agencies.

Guidelines on how to practice FMNR were given, but one key factor to its widespread appeal and success is that farmers themselves controlled the process.

Farmers choose the stumps they will manage, how many stems they will prune, when and how they will prune the stems, and when they will harvest the wood and what they will do with it. Because FMNR can become a grass roots movement, large areas of land can be ‘re-treed’ rapidly and for little or no cost, resulting in increased bio-diversity and benefits to people (i), the environment, soils, crops and livestock.

At a time of unprecedented forest destruction and increased demand for agricultural land, FMNR has much to offer not only Africa but also the world. Development practitioners, Government and Non Government bodies concerned with the environment, agriculture and/or forestry and farmers themselves would do well to study the Niger experience outlined in this paper, and consider if FMNR could be applied to their particular situation.

Background

Missionaries from the Society of International Ministries (SIM) began working on forestry interventions with local farmers in Maradi Department, immediately after famine relief activities in 1975. The Maradi Wind Break and Woodlot Project eventually became the Maradi Integrated Development Project (MIDP) funded predominately by the Canadian International Development Agency.

It was very evident in 1975 that if large-scale famines were to be averted in the future, something needed to be done to reverse the staggering tree loss and severe environmental degradation which had been exacerbated by drought. However, SIMs early attempts at reforestation were small scale and could not impact the environment at large. Nor did these efforts capture the hearts and minds of the community, as little was attempted beyond prescribed project activities. This was a common pattern witnessed by most government and non-government forestry projects at the time.

Travelling in any direction from the project base, one was struck by endless windswept plains, stripped of practically all woody vegetation. The fatalistic outlook of those most affected, who declared that it was God’s will and there was nothing man could or should do about it, compounded the difficulty of restoration.
Women bore the brunt of the crisis, having to walk many kilometres in search of wood. As supplies diminished, they turned to poorer quality fuels such as millet stalks and dung. Occasionally one came upon fences made in the past – large logs planted side by side along a compound perimeter, however, many homes had no fence at all, and where fences existed, they were predominantly falling down.

Pruning transplanted tree seedlings on deforested land. The sheer scale of deforestation almost guaranteed that conventional methods of reforestation were doomed to fail. Even with enormous budgets and manpower, most large projects were proving unsustainable and they failed to realise significant acceptance from the communities meant to benefit from tree planting. Typical farm land (pre FMNR) was cleared of all vegetation. In fact, a good farmer was considered a ‘clean’ farmer who axed, burnt and swept his fields clean!

Left: Bush nursery with barren landscape in background symbolises the futility of combating desertification by this means alone.
Due to the lack of wood, grain silos and huts were often in need of urgent repairs. As scarcity of wood increased, poorer and poorer quality materials were used, and structures needed repairs and replacement more frequently. At funerals in some districts, the bereaved turned to using bricks as a cover for the corpse, instead of wood. Ironically, rural people who once supplied towns and cities with wood began travelling 50 Kilometres or more to buy it. As trees disappeared from fields, emerging crop seedlings took the full force of winds which reached up to 70 kilometres per hour. Seedlings often desiccated after being sand blasted or they were simply buried by sand. Consequently, farmers increasingly found themselves replanting their precious seeds six to eight times in a season. This in turn contributed to diminishing crop yields and hunger.

Reforestation projects in Niger were typically based on ideas developed in temperate climates and in societies and cultures entirely different from those in West Africa. Large, costly tree nurseries were established to produce exotic species, particularly Eucalyptus (E. camaldulensis), Neem (Azadirachta indica) and Prosopis juliflora. Unfortunately, some projects appropriated land from communities without adequate consultation. Plantations were either fenced at great expense, or protected by paid, armed guards. This expensive, top-down approach often alienated rural communities and could never be replicated by them.

In belated efforts to achieve popular ownership and participation in tree planting, community and individually run nurseries were introduced. However, few formally trained project personnel could comprehend the sheer difficulty of raising, planting out and caring for trees in this hostile environment. It was expected that farmers would be happy to draw water by hand for three months. During the dry season when seedlings are raised temperatures can exceed 40 °C. Well depths range between 20 and 60 meters in many villages. Nurseries became small green
oases in a sea of brown which usually attracted termites, frogs, birds and lizards capable of doing great damage to seedlings. Water is so scarce in some villages that usage for tree nurseries is not practical. Once seedlings are planted out, a plethora of hazards including drought, termites, trampling or browsing by livestock, locusts, sand blasting, competition from crops, and even deliberate destruction by humans await them.

Project staff often ignored or were quite unaware of the considerable resentment harbourered by communities. Government forestry agents enforcing tree laws often fined or at times, even imprisoned offenders. The law required farmers to obtain a permit to clear trees on their own land. This system was open to abuse, and was very impractical for farmers living in remote regions. Sometimes thieves would cut and steal trees and the innocent landowner would be fined. Not surprisingly, farmers determined that the less trees in their farms the better.

Beliefs play a big role in determining actions. Farmers saw trees as weeds which depressed crop yields. Little wonder they saw trees as little more than nuisance weeds which should be removed.

Quite needlessly, Maradi Department had its own dust bowl experience. The consultants of one large project, aimed to ‘modernise’ agriculture through promotion of modern inputs and animal drawn implements, complete with the total removal of trees - roots and all! The severe damage inflicted by this ill-advised project is still evident on large tracts of land today. One of the subtle consequences was the reinforcement of the old adage “a good farmer is a clean (i.e. treeless) farmer”. The saying took a more sinister turn, as clearing land came to be equated with modern farming.

Even if people made the connection between the destruction of the environment and the decline in food supplies, few were in a position to change their behaviour. Tradition expected them to clear the land. ‘Modernization’ drives reinforced tradition, making people feel foolish if they did not completely clear their land. On top of all this, severe poverty and hunger forced people to cut the few trees remaining in order to survive. In some cases the roots were even removed.

It has been estimated that over a twelve-year period some 60 million trees were planted in Niger, with less than 50% surviving. Despite the millions of dollars spent on the forestry sector results have been disappointing. In addition to widespread ineffectiveness, some projects left communities hardened and less likely to attempt reforestation activities themselves.

Niger is just one country on a vast continent. Some 34% of land in Africa is threatened by desertification, and each year 2.3 million hectares of open woodlands are harvested or cleared.
for new farmland. In reality, the damage is greater than this when one includes farmland tree
degradation, over harvesting of branches for fuel and fodder and continuous browsing,
stripping and trampling by livestock.(ii) In some African countries, deforestation rates exceed
planting rates by 30:1. Therefore, because destruction is occurring on such a large arena in
Niger, as in the whole of Africa, conventional methods of reforestation are not and possibly
never will reverse the trend of tree loss and desertification.

When attempting to solve a difficult problem it is critical to know what the root cause of the problem
is.
It is also important to analyse the assumptions held about it.

**Foresters generally assumed that:**

- droughts and population driven demand for firewood were causing deforestation
- trees had died or were completely removed by people
- indigenous species grew slowly and were of no economic importance.

**In fact:**

- while drought and firewood demand contributed to deforestation, destructive farming methods,
cultural norms and inappropriate tree laws were the main causes
- While above ground parts of trees were removed, for the most part, the stumps remained and
were alive, with the ability to regenerate
- Indigenous species can grow rapidly, and while most do not provide mill-able timber, they meet
a wide range of basic needs and constitute a significant economic resource.

Simply planting thousands of trees did not make an impact on the deteriorating environment.
Millions of dollars could have been saved if the real problems were understood and if common
assumptions were tested. Incredibly, some projects actually cleared indigenous trees,
considered to be ‘useless’, before planting exotics. They were allegedly ‘useless’, because they
did not grow straight or tall, were assumed to be slow growing, were often knotted and forked
and could not be milled. It was not until a ‘Useless Bush’ study was conducted that it was
realised just how useful these plants were. They provided usable timber, firewood, fodder,
fibres, medicines, fruits, edible leaves and nuts, fodder and dyes as well as many
environmental services.

I realised that even if the project ran for a decade with a large budget, using conventional
methods, it would have minimal impact. The realisation of the futility of the current approach
weighed heavily on myself. In 1983, while on route to a village, I stopped the car and looked
out over the barren landscape and said a silent prayer asking for wisdom and a breakthrough.
Then, for the first time I “saw” what had been there all along – a sea, not of insignificant desert
shrubs, but a sea of felled trees, the stumps of which were re-sprouting. In other words, an
hidden forest just waiting to be discovered.

Each year multiple shoots sprouted, however, they were not given the opportunity to grow to
their full height because of the standard slash and burn practice. Consequently, low-lying
shrubs was all that was visible. As a result, forestry agents did not recognise that these shrubs
were actually felled tress with the capacity to regenerate. The fact that the true nature of this
vegetation was not realised led to the coining of the term ‘the hidden forest’.
Discovering the hidden forest totally changed our approach to reforestation. There was no longer a need to run an expensive nursery. The extreme difficulties of tree establishment could simply be by-passed. The battle lines for reforestation could now be redrawn. Reforestation was no longer about technical concerns such as species choice and planting techniques. The new battle was more about social issues - how to change the belief system of communities who upheld tree felling as necessary. It was also a battle over the legal system whose workings, ironically resulted in the destruction of the trees it meant to protect.

All that needed to be done now was to convince farmers to allow a number of the tree stumps in their fields to regenerate. Over time, farmer’s hearts and minds were won, and they adopted “Farmer Managed Natural Regeneration” as normal practice. Fears that trees in fields would compete with crops were overcome as farmers experimented with FMNR and fine-tuned it to meet their individual needs. FMNR also took on a life of its own as farmers themselves began to spread the new technique. Allowing the hidden forest to grow through FMNR proved to be a highly successful way of rapidly reforesting large areas of land at minimum cost.

i. Benefits include increased firewood and building material and income generation potential.
Farmer Managed Natural Regeneration (FMNR): what it is and how it evolved.

The practice of FMNR has evolved since its introduction in 1983. Farmers have the flexibility to modify the technique to meet their own needs. It is important that they be free to choose the number of shoots per stump and per hectare, the length of the rotation and the method of pruning. Any form of enforcement of FMNR ‘norms’ was avoided by MIDP. The basics of FMNR are very simple:

Desired tree stumps are selected. For each stump, a decision is made as to how many stems will be chosen for growth. The tallest and straightest stems are selected and side branches removed to roughly half the height of the stem. The remaining stems are then culled. Returning regularly to prune any unwanted new stems and side branches attains best results.

Pruned stems of Calotropis procera attained a height of over two meters in just one year. Contrary to popular belief of both farmers and foresters, indigenous tree and shrub species, especially when growing from a mature stump can grow very rapidly.

FMNR is not a new idea. It is a form of coppicing and pollarding: techniques which have been practiced for centuries in Europe. Over 1000 years ago, Europeans ran their woods as a renewable resource by coppice farming of naturally occurring woodlands. Without destroying the trees, they produced poles, wood for fences and construction, and firewood. Ash stands that have been repeatedly cut and allowed to re-sprout on a regular rotation for at least 500 years still exist. What may be new about FMNR is that this method of tree management is being carried out on farmland; land which is normally completely cleared of other vegetation.

In 1983, the thought of leaving trees in crop fields was seen as ludicrous by farmers brought up with the belief that cleared fields were essential for realizing good crop yields. Not surprising, adoption of FMNR
was very slow. The few individuals who tried were often ridiculed. Wood being extremely scarce and valuable, theft of rare stems left in fields was a discouragement to the few who gave it a go. Even if the aggrieved knew the perpetrator, it was culturally unacceptable to report him to the chief.

However, in 1984 radio coverage of an international conference on Desertification held in Maradi greatly increased peoples' awareness of the link between deforestation and drought. The message was strongly re-enforced when the disastrous subsequent drought of 1984 caused almost total crop failure resulting in starvation. MIDP operated a Food for Work program in 95 villages and FMNR was one of the activities. Farmers in a whole district were asked to leave trees on their farms. Having the whole population leave trees over a wide area helped break some of the stigma experienced by the earlier FMNR pioneers. Now, through first hand experience, farmers in the whole district could see for themselves that their crops actually grew better amongst the trees. Other benefits included having extra wood, mostly for home use.

Unfortunately, during this exercise most farmers had only reluctantly practiced FMNR in order to receive food. At the end of the Food for Work program, an estimated two thirds of the 500,000 trees left to grow were cleared. Even so, the seeds of a new idea were sown in over 95 villages for a 12-month period, and for some, fears of ostracism and tree-crop competition were alleviated. Ironically, those who cleared their trees soon experienced a recurrence of their old problems — shortage of firewood and light poles, burial and sand blasting of emerging seedlings, high temperatures, and absence of pest predators in crop land. Even though stealing occurred during the 1984 campaign, most farmers who practiced FMNR were able to harvest something and benefited to some degree from having their own trees. Post 1984, a gradual change occurred, as more and more farmers began practicing FMNR. Today, it is impossible to count the number of trees present on the once barren landscape, but estimates suggest that there are over two million trees standing in the MIDP working area.

Today, Farmer Managed Natural Regeneration in one form or another is a standard farming practice. In fact, an indicator of the extent of the change that has occurred is that a farmer is much more likely to be ridiculed today for not practicing FMNR than for practicing it. The logic behind this is that everybody needs wood, and if you are not growing your own and you are not rich – then you must be stealing or begging from others.

As farmers became confident with FMNR and began to profit from it, it became possible to promote progressively more intensive forms of tree management. There were three main training phases:

- **Modern land preparation**

Farmers graduated from completely clearing and burning all tree regrowth on cropland, to selecting and pruning about 40 stems, (one stem per stump) per hectare.

This modest step into FMNR required a lot of courage by early adopters. Their neighbours often ridiculed them. Some had their young trees stolen or deliberately damaged. Many feared a reduction of food crop yields.
As confidence grew and farmers became convinced of the benefits, and as negative peer pressure diminished, a more intensive form of FMNR was promoted. Even so, ‘modern land preparation’ remains the most commonly practiced form of FMNR.

b) Next-step land preparation

Instead of only leaving one stem per stump, five or even more stems were left. The intent was that one stem would be harvested each successive year, and each year, a replacement young stem would be encouraged. The longer a stem is left to grow, the greater its size and value. Stems on fifty to one hundred stumps per hectare were pruned in this way. This was the ideal taught by MIDP, however practice varied from farmer to farmer.

A very significant change in mindset and practice was occurring. Trees were no longer considered as nuisance weeds needing to be chopped down. The majority of the population were now seeing trees as valuable cash crops in their own right. Where force and appeals to save the environment failed, the sheer economic benefits of farming trees began to bring about radical changes in farming practice. It was now time to introduce a third modification.

c) Profit from every stump.

For a significant part of the eight-month dry season, woody vegetation continues to grow and has the potential to provide benefits to the farmer and the environment. Farmers were encouraged to leave and prune five stems on every stump growing on their land for at least the duration of the dry season.

Some fields contained in excess of 200 stumps, so with this method, farmers could effectively manage a young forest. Prior to sowing crops, farmers could harvest stems, leaving only the number of trees that they required or that suited their crops. Stems produced over one dry season are still relatively small and of less value than those left for one or two years, but they are of greater value than unpruned stems, which were normally slashed and burnt at the end of the dry season.

Apart from the economic benefits, there are environmental gains. Extra vegetation in the fields results in greater deposition of rich, wind blown silt. Livestock spend more time in fields with increased tree cover, fertilizing them in the process. Greater quantities of organic matter from leaf fall and trimmings are produced, enriching the soil. Habitat, food and shelter are created for predators of crop pests. Practicing “profit from every stump” FMNR, allows idle land to become a productive resource during an otherwise unproductive eight-month dry season.
Species used in FMNR

In Niger, the species regenerated include Bauhinia reticulata, Guiera senegalensis, Ziziphus species and Combretum spp. The species mix will vary from farm to farm, district to district and from country to country. Selection will depend on a number of factors including:

- which species occur naturally
- coppicing ability of these species
- local beliefs and values ascribed to each species,
- uses and characteristics such as thorniness, competitiveness with crops, and growth rate.

| A principle of FMNR is to use whatever is available. |
| Make your starting point one of documenting existing species and their importance in the local culture. There may well be a niche for exotics, particularly fruit trees, but the great potential of what is already present should not be ignored. |

Benefits of FMNR

- Firewood and building timber:

Pre FMNR, rural people had to travel to Maradi to buy firewood and building materials which had mostly been brought up from remnant forests on the Nigerian border. Women had no choice but to travel long distances in search of wood. As it disappeared, they substituted crop residues and dung for firewood. Today, FMNR meets domestic demand, and a significant surplus is sold. For example, in 1984 barren plains surrounded the village of Sarkin Harsi. Today, lightly wooded fields surround the village which boasts a thriving wood market. Merchants come twice weekly to buy wood for resale in Maradi.

![Land Rover taking load of firewood to city market.](image)

- FMNR contributes to land reclamation:

A significant spin off from FMNR is the restoration of otherwise un-usable, hardpan sites and nutrient-depleted sandy soils, without financial expenditure.

On hardpan sites, harvested branches are simply left in a pile for a period of time, resulting in:
• **Termite activity.** In search of food, termites burrow through the hard soil crust, breaking it up in the process.

• **Better water infiltration.** Rainwater can now penetrate the broken crust instead of washing off.

• **Silt deposition.** Turbulence caused by winds passing over the woodpile causes deposition of silt rich in organic matter. Topsoil deposits 30cm deep have been recorded.

In this manner, farmers restored hundreds of hectares of hardpan sites, which had been idle for decades. They did this free of charge, and independent of any NGO or government program.

Cut branches have attracted termites. Note: clay ‘tunnels’ built by termites to preserve moisture while they work.

Similarly, practicing FMNR rejuvenates farmland that has been depleted of nutrients. The trees draw nutrients from deep in the soil profile, returning them and organic matter to the soil surface through leaf fall. Trees cause winds to drop their load of nutrient rich silt and provide perches, nesting sites and food for birds which deposit their droppings. The shade and edible leaves and pods also attract livestock, which enrich the soil. Sites treated in this manner are suitable for cropping again within two years.

■ **FMNR positively impacts crop yields and animal production:**

Browse from trees and shrubs are critical to livestock production in the Sahel. For much of the dry season grasses are in very short supply. Continuous high stock carrying rates and manual harvesting of grass leave vast areas completely bereft of vegetation. One of the few foods available is dry millet stalks which have a very low nutritional value. Before the introduction of FMNR, it was common for oxen to be too weak to plough fields at the end of the dry season and for suckling lambs and calves to be severely malnourished because their mothers had insufficient milk. Tree species being regenerated in Maradi produce nutritious pods which are eagerly eaten by livestock. Additionally, some farmers now earn extra income by collecting and selling pods of Faidherbia albida.
As animals spent more time in the shade of trees and in search of falling tree pods, soil fertility on treed fields increased through their dung and urine. Trees protect crops from extreme weather conditions: high temperatures; strong winds which may exceed 70 kilometers per hour; and high evaporation rates. Trees enrich the soil, as described in the previous section while dust depositions on the leaves and droppings of birds attracted to the trees can also be significant\(^i\). In the absence of shade, plants experience increased heat and water stress as soil temperatures may exceed 60 degrees C.

Pre FMNR, all crop residues were removed from fields for use as cooking fuel and for animal fodder. The production of firewood from trees, and the benefits animals receive by accessing tree pods, has for the first time in decades, enabled farmers to leave crop residues on the field, leading to increased crop yields. In the past, limited availability of crop residues was a major constraint to their application as surface mulch\(^ii\).

- **FMNR increases biodiversity and reduces dependence on pesticides:**

As habitat disappeared with the widespread loss of trees, so did wildlife. By the early 1980’s apart from certain bird species, wildlife was rarely sighted. Foxes, wild cats, ground squirrels, hedgehogs, lizards, rats, mice and frogs were the main species remaining, though for the most part, not in large numbers. As the trees returned, this began to change, as particularly heavily treed sites saw the return or at least visit of...
monkeys, wild guinea fowl and rabbits. Predators including birds, lizards and certain insects (preying mantis, wasps etc) began to find shelter and places to breed, making a positive impact on crop yields by reducing insect pests. This lifted a great burden from farmers who could not afford pesticides.

Preying Mantis egg sacs. Preying Mantises only seem to set their egg sacks on woody stems. When trees are cleared, many useful predators such as these simply disappear for lack of habitat.

FMNR contributes significantly to the local economy:

In a twelve-year period, it was conservatively estimated that US$ 600,000 worth of wood was sold as a result of practising FMNR in Maradi (1994-1997 MIdP Summary Report).

Left: Value added products such as hut rooves and tool handles bring in additional income. This was not possible before FMNR was introduced.

From the first year of practicing FMNR light firewood is collected from pruned branches. From the second year on, cut branches can be sold. As wood availability increases, value added products such as hut rooves and tool handles can be made and sold for additional income. In a twelve-year period, it was very conservatively estimated that US$ 600,000 worth of wood was sold as a result of practising FMNR in 100 villages in Maradi Department.

Conservative values for income generating potential can be easily calculated:

<table>
<thead>
<tr>
<th>Area: 1 hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Trees protected: 40/hectare</td>
</tr>
<tr>
<td>No. stems protected per tree: 5five stems/stump</td>
</tr>
</tbody>
</table>

If the farmer prunes 5 stems on each of 40 stumps per hectare and harvests only one stem per stump per year, always encouraging a replacement, by the 6th year, she/he could have an assured annual income into the future in the order of 70,000 cfa (US$ 120/year).
Thus, over a six year period, a farmer could earn over $512, and $140 per year per hectare each year after that. This may not seem much, but in context, most families total income is only about twice that – and most of their ‘income’ is eaten. The figures used in the calculations are also deliberately low and account is not made of other benefits such as increased crop yield under FMNR (At least 2 times yield increase), wood trimmings used for home consumption, fodder value of leaves and pods, food items etc. When wood is converted into hut roofs or tool handles, the monetary value is higher than that of firewood. Additionally, leaving 40 stems per hectare is a minimal amount. Some farmers are leaving up to 200! They may not leave all 200 for the duration of a six year period, but they do benefit from harvest and sale of a larger volume of wood each year.

Some farmers may not have much land at their disposal. My observation in West Africa, is that there are many millions of hectares of ‘common land’ and grazing land gradually degrading and becoming less and less productive. With a participatory approach which includes all stakeholders (farmers, nomadic herders, men, women, youth etc), what would be possible on such vast areas?

In November and December, 2005, Mr. Chris Reij from CIS, Vrije Universiteit, Amsterdam and wrote: FMNR seems more widespread and therefore more spectacular than I thought in June. “On the way back to Niamey (capital of Niger) we had made the following calculation on the back of an envelope about the scale of natural regeneration in Niger: the distance between Dosso and Zinder is about 800 km, we assume that Natural Regeneration occurs up to 100 km north of the road linking these two cities and that it concerns 25% of this area of 80,000 km² or 2,000,000 hectares (to be verified). Using averages, the value of these trees can be calculated. If there are 2,000,000 hectares treated with FMNR, there are between 40 and 80 million trees where just 20 years ago there was practically nothing. The monetary value of these trees is between US$ 28 million and over US$56 million. This does not include the value of crop protection, increased soil fertility, or the value of lives saved and suffering reduced when families have ready cash from sale of trees to meet medical and food needs quickly.

The area now treated with FMNR is even more spectacular when you realize that in 1983 much of the area was completely cleared. In Maradi, only twelve farmers were tentatively practicing FMNR on as many hectares. In 1984, due to famine, some 500,000 trees were managed through FMNR in approximately 100 villages. This increased to about 2,000,000 trees in 1988 through a second food for work program. Beyond 1988, FMNR took on a life of its own and has spread across the country, through other Non Government Organizations, Farmers groups, Peace Corps and through Maradi Integrated Project Staff and farmers visiting new areas across the country and sharing their experience.
FMNR contributes to the quality of life.
The quality of life has improved. Wind velocity at ground level and incidence of irritating dust storms has been reduced. Shade is now available, giving protection from 40°C plus temperatures. Trees reduce the reflection of light from white sand, greatly reducing eyestrain. The once barren landscape is now more relaxing and pleasing to the eye.

- Human food:
A number of tree species being regenerated are a source of edible leaves and fruits. Some of these foods are only eaten during times of food shortage, but they do fill an essential gap which was missing. Other foods are sought after eagerly, and eaten whether or not regular foods are available. During recent famines, fruits and leaves from regenerated trees FMNR were the only foods standing between the people and starvation.

Possible constraints in adopting FMNR

- Presence of live tree stumps:
Ability to practice FMNR is dependant on the presence of live tree stumps of useful species which can be coppiced. Even so, in some situations it is possible to broadcast seeds of indigenous species and use the ensuing trees as the basis for FMNR. More time is required between seed sowing and first harvest, and high mortality rates can be expected during establishment phase. Trees established in this way are eventually managed in the same way as regrowth from tree stumps would be.

- Distance to markets:
There is a severe wood shortage in most districts in Niger. Even when farms are not close to markets, the benefits of FMNR make this activity worthwhile, though farmers closer to markets will realize greater financial gains from sale of wood and other tree products. Though prices are lower in remote areas, due to severe wood shortages, wood is always marketable.
Respect for private property:
It is critical that the general population respect private property. It is common in Niger to treat all land as common property once the harvest is in since there is free access to farmland during the dry season. Farmers initially received little sympathy from village chiefs if they complained that someone had cut their trees down. In any case, farmers were unlikely to report theft because it was considered anti-social to inform on others. This prevented many from even trying FMNR. MIDP staff worked hard to introduce the idea that it was just as big an offence to steal someone’s trees as it is to enter someone’s home and steal his belongings.

Ridicule:
It was common for those who did things differently to become the butt of jokes. For many, this negative pressure was too great and they were discouraged from trying anything new. MIDP encouraged innovation and tried to create an environment which was safe to experiment and that failure of an experiment should not result in embarrassment.

Deeply ingrained attitudes:
Language may give clues to negative attitudes about trees. For example, in the Hausa language, the word for tree (itce), is the same as the word for firewood. This may indicate that trees are given no intrinsic value of their own, apart from their utility for firewood. Much can be done to teach community members about the value of trees and change deeply ingrained attitudes, as shown by the effect of the International conference on Desertification. Pride in the history of a people group may be a hidden factor shaping attitudes. As with any society, children are brought up hearing the stories of their forebears. In Maradi Department, it is only within the last century that Hausa families moved from the Maradi River valley to the heavily treed sand plains North of the city. The current generation is proud of the pioneering spirit displayed by their forebears who cleared the land and made it possible to farm. Project staff need to be careful how they portray those who clear land. For example, linking the pioneering spirit of those practicing FMNR with that of those who settled the land may be helpful.

History and tribal interactions:
An understanding of the history of the various tribes and their interactions is invaluable. Fulani cattle herders, equate chopping and selling wood with the lifestyle of their traditional enemies, the settled farmers. A study of actions and characteristics of the ‘model’ person in a given culture goes a long way to help in understanding why people do or don’t do things, and gives insights into harnessing the power of culture to introduce change.

Critical mass:
Wherever possible, it is important to convince the majority of a given population the value of FMNR. When only a few individuals practice FMNR for the first time, they may be completely discouraged by their peers through ridicule and theft.
■ Climatic factors:
Trees that are regenerated are indigenous and generally have mature root systems, thus drought should not significantly affect growth rates. Deep-rooted perennial species used in FMNR in Maradi not only survive but also continue growing even when rainy seasons are poor. Re-growth of trees in lower rainfall areas, (below 200 mm), will be slower and the harvest rotation period will be longer than in higher rainfall areas. The potential for FMNR in the 800mm plus rainfall areas of Southern Chad and Southern Ethiopia is enormous.

■ Insect pests:
Three are no recorded accounts of significant insect damage on indigenous species used in FMNR. Even when locust attack occurs, indigenous species usually recover after the locusts have moved on.

Reasons for the successful spread of FMNR in Niger.

■ Conducive legal environment:
In the past, farmers did not own the trees on their land. Local forestry authorities granting informal approval for farmers to be able to reap the benefits of their labours. This cleared the way for FMNR to spread unimpeded. When trees belonged to the government, in the minds of the people, they belong to nobody. Hence everybody had the right to cut them down! Once farmers had the assurance that they owned the trees on their land, they did everything in their power to protect them. Without this sense of ownership, FMNR could never take hold and spread. It is only because of an informal guarantee that they would benefit from their labours, that farmers continued to practice FMNR, even after the food for work program phased out. The practice even spread by simple word of mouth, from farmer to farmer.

■ Severe wood shortages resulted in a desperate situation:
Rural people had to go to the city to buy wood. Buildings were collapsing for lack of durable building material. Women were walking long distances to collect fuel. The substitution of millet stalks and manure for firewood resulted in competition for these scarce resources. This serious need cultivated a climate in which change became possible.

■ Timing of international attention on the problem:
The International Conference on desertification followed by severe drought and famine and MIDPs Food for Work Program promoting FMNR made a big impact on attitudes. Perhaps for the first time a link between drought and famine with the disappearance of trees was made. People not only began to comprehend that they were partly responsible, but also that they could do something about it.

■ Trust:
MIDP staff and their SIM predecessors worked for many years in the district building friendships and trust. They were responsible for benefits including wells, famine relief and agricultural development.

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Even though the message of FMNR was strange, the messengers were trusted, greatly facilitating its adoption.

■ Local control:
Establishment of community based regulations on trees was encouraged by MIDP. The village chief and not a distant forestry agent now dealt with theft. Difficult cases were referred to the district chief. Once farmers gained confidence that their rights would be respected and defended, FMNR began to flourish. MIDP, with support of district chiefs, encouraged farmers to break with tradition and act against offenders, whoever they were.

■ Simplicity and cost effectiveness:
FMNR is easy to practice, does not require significant extra work over normal land preparation and is cheap, requiring no financial outlay.

■ Accessibility:
Anybody male or female, rich or poor, who has land containing live tree stumps, can practice FMNR.

■ Profitability:
FMNR is extremely profitable and utilizes a renewable resource.

■ Compatibility and complementarity with essential activities:
FMNR has a positive effect on crop yields and livestock. If there were negative impacts, it is unlikely that poverty stricken farmers who regularly face hunger would adopt FMNR.

■ Self-replicating:
FMNR spread from farmer to farmer by word of mouth. It did not depend on large projects or proclamations of government or NGOs.

■ Perseverance:
The MIDP staff persevered in the face of many obstacles and setbacks including prejudice and handicapping laws. It took at least five years for FMNR to become acceptable and around eight years before it was established enough to not require ongoing project encouragement.
Conclusion

Desertification and land degradation continues to expand on a massive scale in Africa. Despite enormous expenditure of funds and manpower, traditional forestry approaches have failed to stem the destruction. These expensive, often inappropriate approaches rarely capture the hearts and minds of communities most affected.

Farmer Managed Natural Regeneration (FMNR) relies on local management of existing indigenous species. Where practicable, it should be considered as a rapid and cost-effective approach to reforestation. FMNR is easy to adopt and adapt to local needs. FMNR is cheap to implement and has the potential to quickly increase tree cover on a large scale. FMNR benefits soils, crops, livestock, the environment and local communities. Once grasped by the community, FMNR has the potential to become a people movement that spreads by word of mouth, from farmer to farmer, without ongoing project intervention.

FMNR’s potential to reserve desertification and land degradation while positively impacting the welfare of communities is enormous, yet it is little known or appreciated. Wherever conditions are appropriate, foresters, agriculturalists, project planners and farmers can benefit from the practice of FMNR.

In describing the benefits of FMNR, this paper is not discounting the value of tree planting schemes. In some regions, there are no live tree stumps in the fields which can be regenerated. A number of tree planting projects have been very successful (e.g., CARE Internationals Windbreak project in the Maaja valley of Niger). For certain tree species such as fruit trees and valuable rare or exotic species, a nursery may be the only way of propagation. However, for rapid, cheap and ongoing reforestation beyond the life of the project, FMNR should be given high consideration.
Left: Circa 1984 before FMNR was introduced in the village of Sarkin Hatsi, this type of land preparation was considered normal.
Right: Sarkin Hatsi today, FMNR has become standard practice.

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Acronyms
FMNR: Farmer Managed Natural Regeneration
MIDP: Maradi Integrated Development Project
NGO: Non Government Organization.

Glossary
Browse. Leaves, small twigs and shoots of shrubs, seedling and sapling trees, and vines available for forage for livestock and wildlife.
Coppice.
1. A method of cutting certain species of trees to encourage them to regrow from the remaining stump. A tree that coppices readily does not require frequent replanting and is, therefore, useful for producing fuel and poles.
2. Shoot developed from a dormant bud on a main trunk.
3. a small wood regularly cut over for regrowth. Also called a ‘copse’.

Maradi. Maradi Department is one of seven Departments or states within Niger Republic. The capital of Maradi Department is Maradi, a city of approximately 100,000 people.

Pollarding. Cutting back in more or less systematic fashion the crown of a tree but leaving a main trunk to 1.5m or so, with the object of harvesting small wood and browse, of producing regrowth beyond the reach of animals or of reducing the shade cast by the crown.