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Compte-rendu de la Consultation d'experts sur les arbres hors forêt

Renforcement de la contribution des arbres hors forêt au développement durable

tenue à la FAO, Rome, du 26 au 28 novembre 2001

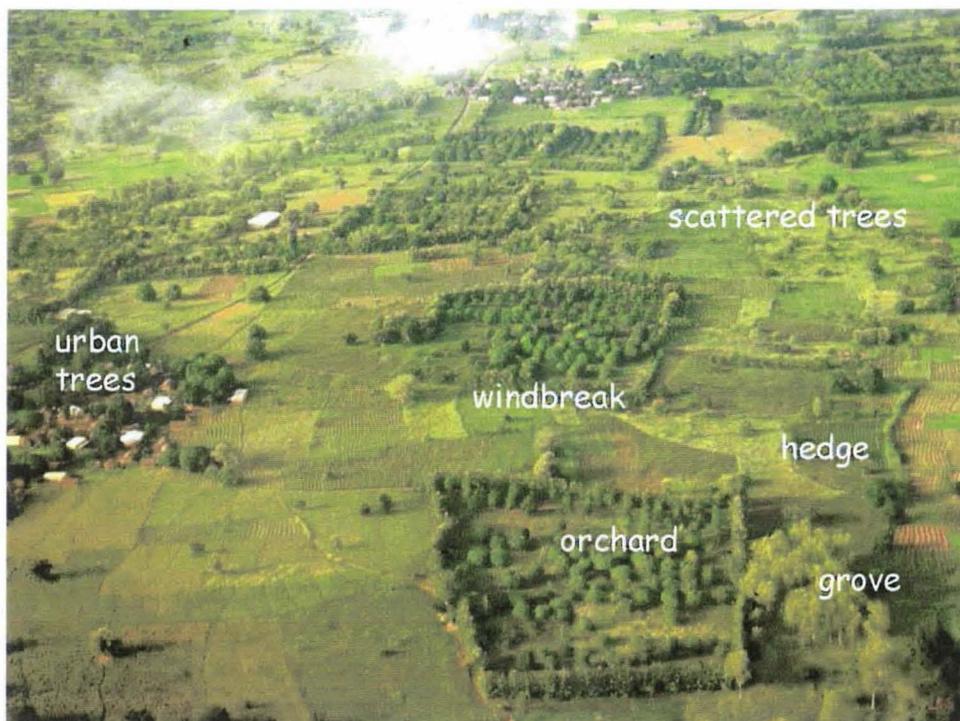


Photo : D. Louppe

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Décembre 2001

Consultation d'experts sur les arbres hors forêt « Renforcement de la contribution des arbres hors forêt au développement durable »

FAO, Rome, 26-28 novembre 2001

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Généralités

La consultation d'experts sur les arbres hors forêt a été organisée à Rome par la FAO à l'occasion de la parution du livre « Les arbres hors forêt ; vers une meilleure prise en compte » publié conjointement par le Cirad et la FAO sous le n°35 de la série « Cahiers conservations FAO ». La rédaction de ce document a été coordonnée par Ronald Bellefontaine avec la collaboration étroite de Sandrine Petit, Michelle Pain-Orcet, Philippe Deleporte et de Jean-Guy Bertault ainsi qu'une participation de nombreux agents du Cirad-forêt et d'autres départements.

Malheureusement, pour diverses raisons techniques, le document n'était pas sorti de presses au moment de la réunion ; une version française photocopiée et reliée a néanmoins été distribuée. Le résumé anglais de 10 pages qui avait annoncé n'était pas, lui non plus, disponible.

Comme la majorité des participants étaient anglophones, les travaux ont été menés sans autres bases écrites que les différentes communications présentées le premier jour. Les travaux ont donc conduit à redévelopper ma majorité des idées et arguments déjà présentés dans le document Cirad/FAO.

Objectifs de la consultation

L'objectif de cette consultation était d'harmoniser les approches multi-sectorielles et d'identifier les contraintes à la contribution des arbres hors forêt (« Arbres hors forêts ») au développement durable en général et en particulier à la sécurité alimentaire et à l'amélioration durable du bien-être des populations.

Plus particulièrement, les experts avaient à se pencher sur les points suivants :

- Echange d'informations sur le statut et les connaissances des ressources « Arbres hors forêts »
- Définir un schéma conceptuel commun (concepts, terminologie, ressources)
- Identifier les points clés, besoins, contraintes et priorités
- Proposer des stratégies, des actions et des partenariats

Déroulement de la consultation

Lundi 26 novembre 2001

- 9h30 : Ouverture de la consultation par M. Hosny El-Lakany (sous-directeur général, département des forêts) et M El-Hadji Sene (directeur, division des ressources forestières).
La présidence de la réunion a été confiée à Jennifer Wong (Université de Bangor) et le secrétariat à Tage Michaelson (FAO).
- 10h : exposé introductif : Syaka Sadio (forestry officer, agroforestry & landuse, Forestry conservation, research and education) "*Enhancing the contribution of trees outside forests to sustainable livelihoods*".
- 10h45 : **Session 1 : Aspects généraux, besoins et tendances** : exposés des participants
 - Christoph Kleinn (CATIE) : "*Trees outside the forest : what do we know and why are we possibly interested*".
 - Dominique Louppe (Cirad) : "*Trees outside the forest : defining them and taking them into account*".
 - Fredua Agyeman (Ministry of land and environment – Ghana) : "*Trees outside the forest : policy and legislative frameworks : the influence on the dynamics of resources related to trees outside the forest*".
 - Olman Segura-Bonilla (Directeur du Centro Internacional de politica economica para el desarrollo sostenible, Universidad nacional, Costa Rica) : "*Social and economic factors influencing trees outside forest development : the Costa Rican case*".
 - Alain Karsenty (Cirad) : "*Trees outside the forest : what incentives and what outlooks studies ?*"
- 14h15 : **Session 2 : Expériences institutionnelles** : exposés
 - Devendra Pandey (Ministry of environment and forest, India) : "*TOF resource case study : Asia & India*".
 - Cinmaya S. Rathore (Indian Institute of forest Management, Bhopal, India) : « *TOF resource study and management : methodologies and institutional approaches in India* ».
 - Peter Castro (Syracuse university – USA) : "*Social and economic factors influencing trees outside forest development*".
 - Tara Bhattarai (FAO-RWEDP) : "*Trees outside forests : the woodfuel production context*".
 - Thomas B. Randrup (Danish forest and landscape research institute, Hoersholm, Danemark) : "*Urbanisation and trees outside forest issues*".
 - Omar Mhirit (Directeur, Ecole nationale forestière d'ingénieurs, Salé – Maroc) : « *Les arbres hors forêts au Magreb, Contexte et tendances* ».

- Babou Ndour (chercheur ISRA/CNRA Bambey, Sénégal) : *“Tree outside forest issues in Africa, with an overview of research carried out, institutional experiences and existing networks and regional initiatives on agroforestry”*.
 - Jenny Wong (School of agricultural and forest sciences – University of Wales, Bangor, UK) : *“Policy, inventory and management of trees outside forest in a densely populated country : a case study of the UK”*.
- 16h35 : Présentation des initiatives de la FAO
 - Mohames Saket (Forest resources development service) : Présentation du programme Evaluation des ressources forestières mondiales
 - Peter Bailey (Forestry policy and institutions branch) : *“How forests can reduce poverty”*
 - Michel Malagnoux (Forest conservation, research and education service) : *“Low forest cover countries and the Teheran process”*.
 - Jim Carle (Forest resources development service) : *« Sustainable forest management in low forest cover countries »*
 - Initiatives éco-régionales :
 - Tony Simons (ICRAF) : présentation des activités de l'ICRAF
 - Synthèse de la journée présentée par El Hadji Sene

Mardi et mercredi 27 et 28 novembre 2001

Les participants ont été répartis en groupes de travail (trois par demi-journée) pour traiter des sessions 3 à 5. Chaque demi-journée a été clôturée par une réunion plénière présentant et discutant les conclusions de chaque groupe de travail. Les conclusions des groupes de travail sont présentées dans les pages suivantes.

- **Session 3 : Définition d'une approche et d'un langage commun**
- **Session 4 : Questions relatives aux arbres hors forêt, besoins et priorités**
- **Session 5 : Aspects institutionnels des «Arbres hors forêts», potentialités et besoins**
- **Sessions 6 et 7 regroupées : Stratégies et actions, conclusions et recommandations**

Les conclusions des sessions 6 et 7 qui ont été menées sous forme de séance plénière, n'ont pu être rédigées en cours de séance. Elles ne figurent donc pas ci-après ; je n'ai pas cherché à les réécrire ici car ce n'est que la synthèse des groupes de travail des sessions précédentes dont les conclusions figurent déjà ici.

Conclusions et recommandations des groupes de travail

Groupe de travail 1 : Les « Arbres hors forêts » : concept, définition et ressources

En général, le groupe accepte les grandes lignes de la définition FAO actuelle des « Arbres hors forêts ».

Le groupe considère qu'actuellement, les « Arbres hors forêts » gagnent en importance et il est vraisemblable qu'ils en gagneront encore plus dans le futur. L'histoire a montré que la définition des forêts a évolué depuis Yangambi jusqu'à Kotka en élargissant l'objectif des inventaires pour couvrir au maximum la ressource.

En accord avec ceci, la définition de la FAO des forêts et celle des « Arbres hors forêts » devrait être révisée, en particulier en ce qui concerne les limites (**surface minimale des parcelles, couvert arboré, hauteur des arbres**).

Les « Arbres hors forêts » doivent également être décrit en fonction des différents systèmes dont ils font partie de telle sorte que cette ressource puisse être inventoriée corrélativement à ses fonctions et ses usages. Par exemple, les arbres seront considérés comme des « Arbres hors forêts » lorsque le peuplement forestier aura une production inférieure à celle de la culture associée. Il en sera de même quand un terrain déboisé retournera à la forêt ou sera transformé en terres agricoles.

Pour cette raison, le groupe propose que la définition des « Arbres hors forêts » se base sur les facteurs suivants :

1. Les fonctions de l'arbre
2. L'usage principal de la terre
3. La situation géographique
4. Les aspects cultureux
5. Les considérations économiques
6. Les considérations sociales
7. Les différences de législation au niveau local, nationale et international
8. D'autres facteurs si cela apparaît être nécessaire

Le groupe recommande que cette nouvelle définition doit être un outil efficace pour l'estimation de la ressource et pour son aménagement (qui va l'inventorier, pour qui et dans quel but ?), pour éviter les oublis et les chevauchements.

Sur le thème de la ressource, le groupe considère que le concept d' « Arbres hors forêts » doit inclure : les espèces forestières, les arbres fruitiers, les arbres d'agrément, les buissons, etc.

Groupe de travail 2 : Evaluation des «Arbres hors forêts» : méthodologies d'inventaire et acquisition de données.

Les données existantes sur les «Arbres hors forêts», au niveau mondial, sont imprécises.

Le groupe de travail s'est focalisé sur les inventaires au niveau national. Toutes les institutions s'occupant de ressources naturelles renouvelables devraient s'intéresser aux «Arbres hors forêts», mais, peut-être, n'est-il pas encore temps de demander aux utilisateurs de s'impliquer dans leur évaluation. Néanmoins, il y a un besoin de définition des «Arbres hors forêts» au niveau des utilisateurs et au niveau national.

Thème 1 : une définition des «Arbres hors forêts» est indispensable pour définir quelles données collecter, par exemple quand faut-il inclure les arbres fruitiers, les buissons, etc.

Il n'existe probablement pas de classification unique des «Arbres hors forêts» en vue de leur évaluation.

Du point de vue de l'évaluation, il y a trois classes principales basées sur la répartition géométrique des arbres : arbres isolés, blocs et bandes boisées. Ceci peut servir de base pour l'élaboration de plans d'inventaire et pour le travail de terrain. L'usage du sol est ici considéré comme un attribut des arbres.

Thème 2 : Attributs. Des attributs supplémentaires sont nécessaires pour décrire toutes les fonctions des «Arbres hors forêts» ; ceux-ci doivent être définis.

1. Couvert (crown-cover)
2. Disposition géométrique (geometric arrangement)
3. Usage des arbres (produits et fonctions)
4. Age, maturité de l'arbre.

Il est nécessaire de collecter des données sur les fonctions écologiques, les biens et les services des «Arbres hors forêts» afin de pouvoir influencer sur les politiques nationales ; des indicateurs mesurables de ces fonctions sont indispensables. Des statistiques sont nécessaires pour permettre l'évaluation du rôle des «Arbres hors forêts» pour le développement durable, la sécurité alimentaire et l'amélioration des conditions de vie.

Thème 3 : Les sources de données.

Les **sources primaires**. Evaluation directe : télédétection et travail de terrain.

Il est bon de disposer de ces données primaires mais celles-ci peuvent s'avérer onéreuses ou très onéreuses comme la télédétection ou les photos à haute résolution permettant l'identification d'arbres isolés.

Les **sources secondaires** d'information :

1. Extrapolation d'évaluations antérieures
2. Informations indirectes : statistiques commerciales et agricoles, revenus nationaux, douanes et accises (TVA)

3. Combinaison de couvertures géographiques incomplètes
4. Estimations d'experts
5. Connaissances locales

Ces données indirectes doivent être collectées mais doivent être pondérées en fonction de l'information obtenue. Ces données sont utiles pour se faire une idée du statut des «Arbres hors forêts», pour préparer une évaluation primaire et pour une meilleure prise en compte.

Thème 4 : Identification des institutions aptes à réaliser l'évaluation

Les «Arbres hors forêts» sont d'une importance multi-sectorielle et devraient relever d'un partenariat organisé entre les institutions intéressées sous le chapeau d'une institution leader. Ceci peut différer d'un pays à l'autre. Il est nécessaire d'identifier l'institution leader ainsi que les partenaires.

Thème 5 : Réalisation des inventaires

En fonction du contexte national, l'inventaire des «Arbres hors forêts» pourra être réalisé indépendamment ou en combinaison avec celui d'autres ressources.

L'expérience acquise dans les inventaires forestier, notamment en échantillonnage, en plans d'inventaire et en organisation de leur réalisation est conséquente mais devra néanmoins être adaptée aux «Arbres hors forêts».

Thème 6 : Résultats des inventaires

1. Statistiques sur les quantités
2. La cartographie des ressources «Arbres hors forêts» – peut-être des cartes présentant les densités d'arbres – ne nécessitera la télédétection qu'en fonction des échelles retenues.

La cartographie n'est peut-être pas d'une grande priorité – les statistiques sont plus importantes. Faire ou non des cartes dépendra de l'objectif de l'évaluation et du coût de production.

Groupe de travail 3 : Utilisation durable des terres, gestion des ressources forestières et productions agricoles

La valeur économique et environnementale des «Arbres hors forêts» n'est pas reconnue. Leur appréciation et leur promotion est faible par manque de connaissances de la part des politiques et des techniciens.

Intégrer la détermination de la valeur et de l'usage des «Arbres hors forêts» dans les inventaires, etc.

Proposer des plans d'actions incluant des changements de politique, de la formation (des politiques, des techniciens, etc.) et la reconnaissance de l'importance des «Arbres hors forêts» pour le bien-être.

Différencier les produits provenant des «Arbres hors forêts» de ceux des massifs forestiers : les marchés et l'utilisation durable des «Arbres hors forêts» seraient améliorés si l'on différencie leurs productions de celles des forêts.

- Régulation,...
- Appui aux producteurs/productions des «Arbres hors forêts»

Propriété de la terre, des arbres et des produits : une attention particulière doit être portée aux problèmes d'appropriation :

- formelle ou informelle
- appropriation du sol, des arbres, des produits, usufruit,
- l'environnement politique et législatif doit prendre en compte les pratiques locales.

Secteur informel : l'importance des «Arbres hors forêts» dans le secteur informel doit être reconnu, accepté. Des modifications de politiques devront faciliter et supporter le secteur informel pour une utilisation plus efficace des «Arbres hors forêts».

Biodiversité et «Arbres hors forêts» : les politiques, le contexte législatif et les pratiques locales vis à vis des «Arbres hors forêts» doivent permettre de maintenir ou d'augmenter la biodiversité. Documenter la contribution des «Arbres hors forêts» à la biodiversité (incluant son rôle dans l'amélioration des conditions de vie). Les aspects relatifs à la biodiversité doivent être pris en compte dans les transferts de connaissances incluant les itinéraires agronomiques, l'apprentissage (le transfert de connaissances et de techniques) de fermier à fermier (farmer-to-farmer learning).

Capacité productive : les «Arbres hors forêts» ont une capacité de production d'une grande variété de produits nécessaires au bien-être des populations : celle-ci doit être reconnue.

Groupe de travail 4 : Politiques

Aspects politiques :

1. Il y a un manque de politiques bien définies pour les «Arbres hors forêts»
2. Les politiciens ne sont suffisamment conscients du potentiel des «Arbres hors forêts»
3. Il manque d'institution(s) d'accueil pour les politiques relatives aux différentes situations d'utilisation des terres
4. Les codes forestiers actuels ne sont pas appropriés pour favoriser une bonne gestion des «Arbres hors forêts»
5. L'usage et la commercialisation des produits des «Arbres hors forêts» est fréquemment en désaccord avec les modes d'appropriation et le régime foncier.
6. Il n'y a pas suffisamment d'incitations aux petits propriétaires terriens pour la plantation d'«Arbres hors forêts»

Proposition d'orientations d'actions :

1. Il faut améliorer l'information des politiques sur le potentiel des «Arbres hors forêts» – ceci est à mettre en regard de la volonté à réduire la pauvreté

2. Il est indispensable de fournir des informations bien ciblées aux différents acteurs (politiques, ... propriétaires, ...).
3. Les « Arbres hors forêts » doivent être considérés comme des biens privés et non comme des biens relevant de la législation forestière conventionnelle. Les « Arbres hors forêts » doivent être considérés (regulated) au niveau législatif comme des productions pérennes.
4. La mise en œuvre des politiques sur l'utilisation et la gestion des « Arbres hors forêts » doit se baser sur un consensus au niveau local
5. Un groupe interministériel (ou une commission) doit se rencontrer régulièrement, accueillie alternativement par chacun des ministères concernés.
6. Il faut fournir des incitations aux petits producteurs par une optimisation des prix du marché et par un accès aisé à la commercialisation des produits (safety net – commerce équitable).
7. Impact des politiques non forestières sur les « Arbres hors forêts » : par exemple dans le cadre des politiques énergétiques il faut développer des politiques pour promouvoir les bio-énergies et les énergies renouvelables ; ceci devrait inclure les incitations du MDP.

[Prix minimum garanti (sidising) pour les « Arbres hors forêts ».]

Ne pas se limiter aux politiques de subventions, aux prix du marché, mais aussi se préoccuper de la définitions de politiques adaptées.

Eviter de se focaliser sur des incitations relatives aux aspects de production mais, au contraire, veiller aux incitations pour développer le marché (par exemple systèmes d'information, moyens de transports, etc.) et aux mécanismes de minimisation des risques.

Groupe de travail 5 : Aspects sociaux et économiques, qualité de vie

L'évaluation économique, environnementale et sociale doit être une vraie estimation prenant en compte les acteurs et leurs priorités.

Qui est concerné ?

Connaissance et valeurs : le partage des connaissances doit atteindre les acteurs de terrain, les politiques et législateurs nationaux, les conseillers, les propriétaires, ...
Mais comment faire pour diffuser cette information ?

Schéma analytique : de meilleures pratiques doivent développer les ressources et les aspects économiques et sociaux. Cependant, il ne faut jamais oublier qui sont les destinataires.

Comment ? Hiérarchiser (quoi ?) en cascade, analyse multi-critères... en relation avec les besoins des ménages et avec tous les acteurs.

Groupe de travail 6 : Recherche, éducation et vulgarisation

Remarques générales :

1. Tous les thèmes de recherches sur les «Arbres hors forêts» doivent être orientés par les populations et la recherche du bien-être.
2. Toute recherche sur les «Arbres hors forêts» est nécessairement multidisciplinaire. Cette recherche devrait être internationale car la comparaison de la situation des «Arbres hors forêts» entre différents pays est particulièrement instructive.
3. Il est souhaitable d'établir un réseau de recherches sur les «Arbres hors forêts», la FAO peut être un « facilitateur » potentiel.
4. Le groupe de travail a identifié certains points relevant de la recherche, de l'éducation et de la vulgarisation ; néanmoins, il espère que d'autres thèmes de recherche ressortiront des travaux des autres groupes.

Recherche :

Certains axes clés de recherche ont été identifiés et pour chaque axe quelques thèmes sont présentés. Ceux-ci doivent être considérés comme des exemples ; ils n'ont pas vocation de constituer une liste exhaustive.

1. Acquisition de l'information
 - Intégration de la télédétection et des systèmes d'information géographique à l'évaluation des «Arbres hors forêts»
 - Options pour la cartographie des «Arbres hors forêts»
 - Développement de modèles de croissance (nécessaires pour l'élaboration de plans de gestion durable)
 - Etablissement d'un système d'information sur les «Arbres hors forêts»
 - Compilation des connaissances locales
2. Recherches sur les fonctions écologiques
 - Conservation de la biodiversité
 - Conservation des eaux et du sol
 - Analyse des impacts micro-climatiques
 - «Arbres hors forêts» et fixation du carbone dont sa modélisation
3. Bien-être des populations
 - Amélioration de la sécurité alimentaire grâce aux «Arbres hors forêts»
 - Autoconsommation pour la subsistance des produits issus des «Arbres hors forêts»
4. Législation, politiques et gestion
 - Formulation/développement d'une cadre législatif favorable aux «Arbres hors forêts»
 - Développement de mécanismes incitatifs
 - Développer une méthodologie d'intégration des «Arbres hors forêts» dans le MDP (mécanisme de développement propre)
5. Economie et analyse de marchés
 - La certification et son application aux «Arbres hors forêts»

- Aspects économiques et marchés des produits autres que le bois provenant des «Arbres hors forêts»

Education :

Le groupe s'est seulement intéressé aux universités et aux écoles techniques ainsi qu'à la formation continue ; il reconnaît cependant que l'éducation comprend également l'enseignement primaire et secondaire.

1. En général, les enseignements en foresterie, en agriculture et en écologie ne comprennent aucun programme ou module de formation complet sur les «Arbres hors forêts», bien qu'il existe des formations en agroforesterie
2. Un cours spécifique sur les «Arbres hors forêts» doit se construire avec le temps ; cependant, le groupe considère que l'effort doit être centré immédiatement sur l'inclusion des «Arbres hors forêts» en tant que ressource renouvelable dans les formations déjà existantes en agriculture, foresterie, écologie et écologie des paysages
3. Pour les formations continues, il serait très utile de construire un cours présentant une vue holistique des «Arbres hors forêts» et de les considérant autrement que comme de simples arbres agroforestiers. L'élaboration de cette formation continue pourrait être prise en charge par la FAO.
4. Cet aspect holistique des «Arbres hors forêts» doit également être inclus dans les formations continues en agriculture, foresterie, agroforesterie, aménagement du territoire,...
5. Les thèmes à inclure dans les programmes sont ceux identifiés dans le paragraphe recherche ci-dessus.

Vulgarisation :

1. Les activités de vulgarisation doivent être orientées vers les besoins immédiats des agriculteurs notamment les techniques de pépinière, de plantation, de gestion, la législation, les incitations et les subventions, etc. Le programme concret variera en fonction des situations locales.
2. Il serait utile de développer des supports simples de vulgarisation sur les «Arbres hors forêts» et sur leur importance. Il faut cibler les propriétaires terriens mais aussi les politiques, les législateurs et les décideurs.
3. La vulgarisation doit aussi viser les écoles, notamment les élèves les plus jeunes.
4. Il a été reconnu qu'il existe diverses techniques de vulgarisation, y compris le classique transfert de connaissances, et diverses méthodes interactives de dissémination de l'information.

Groupe de travail 7 : Revue des capacités institutionnelles : études sur les «Arbres hors forêts», évaluation de la ressource ; élaboration, suivi et évaluation de programmes

Types d'actions à entreprendre :

1. De nombreuses politiques et planifications peuvent s'appliquer aux «Arbres hors forêts» comme : l'amélioration des codes forestiers et des programmes forestiers nationaux, la révision du code sur la propriété foncière, la gestion des paysages, les politiques environnementales et énergétiques.
2. La FAO a un rôle international à jouer pour l'échange d'informations sur les «Arbres hors forêts». Pas seulement sur les aspects techniques d'évaluation, mais pour améliorer leur prise en compte et proposer diverses options institutionnelles et opérationnelles.
3. La FAO devrait prendre le leadership du développement et de la diffusion de principes directeurs pour les «Arbres hors forêts». L'amélioration de la définition des «Arbres hors forêts» doit se faire au sein des « initiatives » FAO pour la définition des forêts. Les agences officielles, les ONGs,... doivent être des partenaires de l'élaboration d'une définition des «Arbres hors forêts» utilisable et adaptée à chaque pays et incluant la valeur économique, sociale et environnementale des «Arbres hors forêts»
4. La FAO doit lancer des études pour évaluer les marchés, les retours économiques et la consommation des produits des «Arbres hors forêts»
5. Les acteurs des «Arbres hors forêts» doivent veiller à ce que leurs produits soient différenciés de ceux issus des forêts
6. L'analyse des filières, une participation active dans la filière et plus d'innovations dans l'organisation du marché des «Arbres hors forêts» sont des moyens d'améliorer les opportunités pour les producteurs et pour augmenter les prix des produits et des services issus des «Arbres hors forêts»
7. Il convient d'améliorer les capacités institutionnelles des populations rurales et urbaines en ce qui concerne la production et les services des «Arbres hors forêts», leur valorisation et leur commercialisation.
8. Les actions proposées sur les «Arbres hors forêts» peuvent engendrer des conflits d'intérêt au niveau local ou global
9. Il est nécessaire de faire plus de recherches et de donner plus d'informations sur le commerce et le marché des «Arbres hors forêts»
10. Des réunions sur les TOF doivent être tenues en satellite ou au sein des réunions internationales déjà programmées ; tout autre processus global doit être utilisé pour améliorer la prise en compte du concept et du rôle des «Arbres hors forêts» ainsi que de leurs produits et services. En particulier : UNFF II au Costa-Rica en mars 2002 ; Rio + 10 à Durban en septembre 2002. La FAO doit avoir un rôle de leader dans cette initiative.

Groupe de travail 8 : Systèmes d'information sur les «Arbres hors forêts»

Il serait improductif de développer un système d'information sur les «Arbres hors forêts» indépendant ; il est préférable de l'intégrer dans un système existant d'informations sur les terres et l'agriculture (FRA, WAICENT, etc.)

Recommandation : rechercher le développement des informations sur les « Arbres hors forêts » au niveau international à travers ces systèmes existants.

Une bibliographie annotée sur les « Arbres hors forêts » serait utile pour profiter de l'expérience déjà acquise

Recommandations :

- *La FAO pourrait peut-être prévoir cette bibliographie dans le programme FRA*
- *Structurer le contenu par des mots-clés : politiques, législation, organisation,...*
- *Décider de ce qui doit être inclus : par exemple est-ce que tout ce que l'on trouve dans les systèmes agroforestiers ou sur les terres agricoles doit être inclus ?*
- *Les informations seront collectées auprès des partenaires de chaque pays*
- *Les ressources provenant des « Arbres hors forêts » (RHF) doivent être identifiées et définies en relation avec les partenaires concernés.*

Il se peut que le terme « arbres hors forêts » n'est pas le plus approprié en raison des inter-relations avec les autres secteurs.

Il faudrait lancer un forum électronique pour approfondir le débat sur les « Arbres hors forêts ».

ANNEXES

Annexe 1 : Liste des participants

Annexe 2 : Programme de la réunion

Annexe 3 : Communications présentées (texte intégral)

Expert Consultation on Trees Outside Forests
“Enhancing the Contribution of Trees Outside Forests to Sustainable Livelihoods”
FAO HQ, Rome Italy 26-28 November 2001
List of the Participants

PARTICIPANTS	NAME	COUNTRY	ORGANIZATION	EMAIL
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**Preliminary Programme of the Expert Meeting on Trees Outside the Forest
“Enhancing Trees Outside The Forest Contribution to Sustainable Livelihood”**

-0—0-

**FAO HQ, Rome Italy
26-28 November 2001**

AM	PM
DAY 1 – 26 November 2001	DAY 1 – 26 November 2001
<p>08H-09H15: Arrival and registration of the participants</p> <p>09H15-09H45: OPENING (Chairperson)</p> <ul style="list-style-type: none"> • Logistic and Presentation of Programme (<i>Co-Chairperson</i>) • Round table Introduction by participants <p>09H45-10H00: COFFEE BREAK</p> <p>SESSION 1: GENERAL ISSUES, NEEDS AND TRENDS</p> <p>10H00-12H30: Presentation of 5 Key Papers (30 minutes including discussion)</p> <p>12H30-13H00: Plenary and closure</p> <p>13H00-14H15: LUNCH</p>	<p>SESSION 2: INSTITUTIONAL EXPERIENCES (Presentation of experiences and on-going programmes – Background Papers)</p> <p>14H15 Opening</p> <p>14H30 – 15h15 Presentation of FAO’s activities (10 minutes, including discussion for each paper)</p> <p>15H15-15H45: Presentation of CCD and Teheran process</p> <p>15H45-16H: COFFEE BREAK</p> <p>16H-17H15: <i>Cases studies</i></p> <p>17H15-17H45: <i>Eco-regional initiatives</i></p> <p>17H45-18H00: Plenary and Closure</p> <p>18H00: COCKTAIL</p>
DAY 2 – 27 November 2001	DAY 2 – 27 November 2001
<p>SESSION 3: Defining common language and approach</p> <p>09H00 – 12H15: Working Groups 1, 2, 3 at work (Meeting Rooms), including Coffee break</p> <p>12H20-12H40: Plenary and closure</p> <p>12H40-14H00: LUNCH</p>	<p>SESSION 4: TOF ISSUES, NEEDS AND PRIORITIES</p> <p>14H00–17H15: Working Groups 4, 5, 6 at work (Meeting Rooms), including Coffee break</p> <p>17H15-17H45: Plenary and closure.</p>
DAY 3 – 28 November 2001	DAY 3 – 28 November 2001
<p>SESSION 5 : TOF INSTITUTIONAL CAPACITY AND NEEDS</p> <p>09H00 – 12H15: Working Groups 7 & 8 at work (Meeting Rooms), including Coffee break</p> <p>12H20-12H40: Plenary and closure</p> <p>12H40-14H00: LUNCH</p>	<p>SESSION 6 : STRATEGIES AND ACTIONS FOR SPECIFIC MECHANISMS</p> <p>14H00–16H00: Working Groups 9 & 10 at work (Meeting Rooms)</p> <p>16H00-16H20: Plenary and closure</p> <p>16H20-16H45: Coffee break</p> <p>SESSION 7: CONCLUSION AND RECOMMENDATIONS</p> <p>16h45-17h15: Discussions and adoption of the final conclusion and recommendations</p> <p>17H15-17H30: CLOSURE OF THE MEETING</p>

EXPERT CONSULTATION ON TREES OUTSIDE FORESTS

**“ENHANCING THE CONTRIBUTION OF TREES OUTSIDE FORESTS TO SUSTAINABLE LIVELIHOODS”
(FAO/HQ, Rome, 26-28 November 2001)**

By

**Dr Syaka SADIO
Agroforestry and Land Use Officer
FOR/FORC, Rome, Italy**

1. Introduction

Trees Outside Forests have been for centuries recognised to play an important role in rural and urban development. It has been well integrated into the agricultural production systems and urban settlements.

For instance, in arid and Semi-arid zones of Africa and Asia, TOF constitute the main source of firewood and non-wood forest products. In Savannah areas, farmers may often conserve on their lands high percentage of trees to control soil erosion, improve the soil fertility and for domestic uses (fruit, firewood, medicines, forages, etc.). In countries with low forest cover (LFCCs), Trees Outside Forests constitute the main source of tree products and are at the heart of land resources conservation strategies. In places with extensive forest areas, TOF as they are generally more accessible, may still offer major contribution to household livelihood. In fragile ecosystems (drylands, mountains, watersheds and densely populated areas) TOF contribution deserve special attention.

The importance of the Trees Outside Forest (TOF) in providing goods and services is being increasingly recognised by institutions involved in natural resource planning, management and monitoring, as by those concerned with forestry, agriculture and livestock. However, TOF development is affected by several constraints: i) lack of general awareness among managers, policy and decision makers about the role and potential of TOF in supplying social and economic products; ii) the non-competitive economic return and the low economic incentive for the husbandry of tree-based systems compared to other land use (annual crops), iii) the unfavourable policy and inadequate institutional support (land tenure and legislation) to tree based systems. In addition, TOF have not been systematically taken into account in forest resource assessments and management processes. The use of trees in conjunction with other land uses is often faced with land tenure systems.

Several countries have been assessing in various ways TOF among the resources contributing to wood and non wood “forest” products supply, land and ecosystem conservation and poverty alleviation. Studies have shown that economically and environmentally-sound TOF systems can increase wood and non wood product supply, improve land productivity, reduce pressure on forests, contribute to ecosystem conservation and improve urban environmental conditions. It is also expected that efficient use of TOF information will improve the economic and ecological valuation of these resources and help to eliminate policy and economic constraints to their sustainable use and conservation.

During the last 2 years, a specific attempt has been made to collect information on TOF at national and international level and promote dialogue around them. The FAO/IRD (ex-ORSTOM) workshop in Orléans, France (21-23 September 1998) and the ICRAF/Sokoine University "Off-Forest Tree Resources of Africa" workshop held in Arusha, Tanzania (12-16 July 1999) confirmed the importance of harmonizing concepts and activities at national and international level. Other works as those undertaken by FAO (FRA 2000, Africover and the EC projects on forest data collection), CATIE, FSI and many other institutions constitute a rich source of information and expertise in the process to develop standardised, efficient, cost-effective methods for planning, monitoring and assessing TOF. Countries and institutions have accumulated sparse knowledge on the status of TOF resources and on the methodologies of assessment, in line with national and institutional perspectives. The FAO Conservation Guide No.35 (in printing) highlights TOF issues through 8 case studies based on an extended review of bibliography, studies and discussions, shows the extent of this knowledge.

One conclusion arising from all these recent developments is that issues related to TOF must be analysed in the context of environmental protection and sustainable forest management, as well as sustainable agriculture and planned urbanisation. The Forest Resources Division within the Forestry Department is interested in facilitating the identification of roles and responsibilities among all major actors concerned by TOF and promote collaboration among them. Such collaboration offers potential for common approach to outstanding issues related to definition, policy design and programme development including legal aspects to enhance TOF contribution. In this, special attention will certainly be given to a) the environmental contribution of trees on farmlands; b) the productivity and economic return of tree outside forest, and; c) the general contribution of trees to rural and urban livelihoods.

We are convinced enabling dialogue between researchers, trainers, professionals and practitioners from various sectors to discuss and share common vision could be a good opportunity to agree on the concept and definition, discuss key issues and elaborate on elements of an action programme to move forward towards sustainable livelihoods. During these three days, we will have to discuss analytical framework and methodological tools for studying TOF, identify key areas for future cooperation and eventually recommend strategic components in national programmes (e.g. national forest and agricultural programmes) and international processes and agreements (e.g. Teheran process, CCD, CBD and UNFCCC). The Consultation builds on the results of previous meetings as referred above and will probably lead to an other Expert Consultation on policy issues towards end 2003.

2. Objectives of the Expert Consultation

The major objectives of these consultation is to harmonize cross-sectoral approaches and identify constraints to the contribution of Trees Outside Forests to sustainable development in general, and in particular to food security and sustainable livelihoods.

The Specific objectives are to: i) exchange information on the status, related issues and knowledge on TOF resources; ii) define a shared conceptual framework (concepts, terminology, resources); iii) identify the key issues, needs, constraints and priorities; iv) propose strategies, action and partnership for the promotion of TOF and development of methodologies for resource assessment in the framework of on-going mechanisms; and v) enhance TOF contribution to sustainable livelihoods by (i) improving national policy framework, (ii) strengthening information and knowledge systems and (iii) fostering the

participation of concerned actors in the decision-making processes related to forest product supply, land and ecosystem management, and poverty alleviation.

To this extent it is understood that we will have to establish a common language and approach of work, look at the institutional capacities, raise awareness and propose priority action plan in order to respond to local needs, national priorities and to global norms, agreements and international conventions.

3. Concept of Tree Outside Forest

In early seventies some authors have pointed out the importance of trees in agricultural land and production systems. However, only during this last decade, the concept of TOF has been given much importance. TOF concept has yet to be clearly defined.

Many attempts have been made to reach a consensual definition. According to FAO definition, "Trees Outside Forest" are the *trees, shrubs and their systems* on land not defined as forest and other wooded land¹. Trees Outside Forests are essentially located on agricultural lands (including croplands and rangelands) and on built-on and settlement areas, both in rural and urban areas. A large number of these systems, but not exclusively, consist of man-made or domesticated and trees. Some of the land use systems include alley cropping and shifting cultivation, permanent tree cover crops (e.g. café, cacao), scattered trees in meadows and pastures, wind breaks, hedgerows, home gardens, fruit tree plantations (e.g. coconut, olive trees, chestnut trees, mango, citrus), road and street plantations, urban parks and line plantations along streams and ponds. *They must cover an area of less than 0.5 Ha with less than 5 percent cover if the height is more than 5m at mature stage, or with less than 10 percent of cover if the height is less than 5m at mature stage. In linear scheme, the width of the plantation must be less than 20 m.*

For better understanding, one should ask following: What is the basis of this definition ? On what basis it corresponds to the livelihoods ? How does it fit into the agricultural production systems?

Depending on various national or institutional perceptions, they may be under the responsibility (resource use and management, decision, policy, economic) of several institutions, including private or individual owners.

On the basis of its role and the wide range of the resource types, to enable sustainable development and to improve TOF contribution to the livelihoods, TOF definition should be seen within a development system rather than simple resource. Furthermore, issues related to TOF must be analysed in the context of environment protection and sustainable agricultural development, and planned urbanisation.

Some specific attempts, i.g. FAO/IRD (ex-ORSTOM) workshop in Orléans, France (21-23 September 1998) and the ICRAF/Sokoine University "Off-Tree Resource of Africa" workshop held in Arusha, Tanzania (12-16 July 1999) have been made to collect information on TOF at national and international level and promote dialogue. They all confirmed the

¹ Trees outside the forest: "Trees outside the forest" are the trees, shrubs and their systems on land not defined as forest and other wooded land. They are on the other lands, which comprise: farmlands (including meadows and pastures), built-up areas (human settlements and infrastructures) and bare lands. They include a variety of trees and shrubs of all functions (e.g. protection, production, amenity, ornamental, landscape) and all domains (e.g. agricultural, forestry and urban development).

importance to harmonize concepts and actions at national and international level. However, further discussion is still needed to (1) clarify the definition of the concept and related terminology; (2) analyse its perceptions and objectives at national level in relation with food security, social, economic and environmental functions; and (3) identify opportunities and constraints as to the best uses of Trees outside forests. In addition, the progress in the development of capacity building and assessment methods need to be highlighted.

Today Expert Consultation aims at clarifying these issues. We will also identify some key activities to be strengthened at local, national, regional and global levels and work on the prospects.

The SESSION 1: General issues, needs and trends will address above issues in order to have clear understanding on the concept, resource assessment and data collecting methodologies, socio-economic role of TOF.

Two Key papers are proposed for discussion:

Paper 1: The world of information :

Trees Outside the Forest: What do we know and why are we possibly interested? Christoph Kleinn. This paper is dealing with what we consider the major problems in discussions on TOF information, including questions that are seemingly basic such as terminology (definition, classification, conceptualization) or functions (economic, ecological, socio-cultural relevance), and others like the missing technical visions and management options for a large area development of that resource, and the missing legal framework in most countries.

Paper 2: **Trees outside of the forest: Definition and for a better recognition**. D. loupe. This paper based on the Conservation Guide 35 – FAO/CIRAD, gives an overview of the TOF issues: definition, recognition and diversity, national politics, consultation and international agreements , social, economic and environmental benefits, better knowledge, and extension and basic training, including resource assessment.

4. TOF Resources (TOFR) assessment

During the last three years, a specific attempt has been made to collect information on TOF at national and international levels and promote institutional dialogue. FAO has assisted country members in looking at these questions and collecting and analysing relevant information from various regions of the world. Some work undertaken by FAO (FRA 2000, Africover and the EC projects on forest data collection), CATIE, FSI and so many other constitute a rich source of information and expertise in the process to develop standardised, efficient, cost-effective methods for planning, monitoring and assessing TOF.

Numerous thematic and national case studies, workshops and networking activities involving experts and national and international institutions contributed to support this process. For instance, in Costa Rica, CATIE, in collaboration with Freiburg University (Germany), is developing a regional methodology for Central America to assess tree resources outside forest. A mix of satellite remote sensing, aerial photos and ground sampling is used to address the complexity of the resource (number of species, distribution and structure) and to allow dynamic monitoring of resources at the national and regional levels (Kleinn *et al.*, 1999).

The objectives were to take stock of the conceptual, methodological, technical, informational and institutional issues related to the resource and to develop methodologies and tools to collect and analyse relevant information.

However, in spite of the limits of the data, the case studies present quite a bit of useful information. The main findings of these case studies can be summarised as follows:

- Much information do, in fact, exist but it is scattered among different institutions and sectors and serves a wide range of purposes;
- The data collection method is rarely reported and this makes interpretation difficult;
- When information exists, it is almost always site-specific and does not always relate products to resources.
- An important part of trees outside forests belongs to the informal sector, making them a “hidden” resource in statistics.
- The economic value of their products is often underestimated and the economic value of their environmental benefits often completely overlooked.
- The information related to trees in settlements and cities is almost non-existent;

One key paper prepared by C.S. Rathore “**TOF Resource Study and Management: Assessment Methodologies and Institutional Approaches in India**” will address these issues. This paper presents an overview of some of the important approaches used in India for TOF assessment. Assessment approaches have been categorized as ground based enumeration approaches or remote sensing aided approaches and discussed in context of their methodological details, merits and demerits. The potential use of remote sensing data has been highlighted as it can add accuracy and speed to certain TOF assessment tasks. A brief discussion on TOF management in India has also been presented focussing on legal issues impacting TOF conservation. The overview suggests that there is inadequate data on TOF resources in the country and there is a need to evolve standard methods and institutional partnerships to collect data. The need to adopt enabling legislation in order to encourage private landowners and local communities to plant and conserve more trees has been highlighted.

5. Role of TOF

In general terms, the results of these studies indicate that TOF are taking an increasing importance for their environmental services, for sustainable agriculture and for their contribution to the supply of wood and non wood forest products.

Assessments results show that in many areas and countries, trees outside forests are important and sometimes the main source of wood and non-wood forest products. Their wise management improves agricultural soil fertility and combats agricultural land degradation, helps secure water production and conservation in mountains and watersheds, regulates micro-climate and aids air and water cleansing in cities, improves temperature and forage conditions for livestock and wildlife and, finally, contributes to the liveability of cities. Indeed, floods, landslides and water shortages in cities and rural areas are often the consequence of the degradation of tree-based systems.

One key paper (A. P. Castro) and several case study papers (Asia, Africa, Europ and Latin Amrica) will address the socio-economic issues and their relationship with agricultural and food production, and livelihoods.

Agro-forestry systems

In France, several laws, incentives and farmer associations promote the establishment of hedgerows in the rural landscape. However, the mechanisation of agriculture and the politics of reallocation of lands (*remembrement*) have caused degradation of hedgerows over the last several decades, a significant factor in soil, watershed drainage and floods problems (IFN, 2000). In fact, the comparison between two watersheds in Brittany, respectively wooded (*bocagé*) and not, put in evidence the role of the hedgerows in regulating the annual run-off, in decreasing the peak flow velocity (Mérot et al., 1976) by facilitating water infiltration into the soil.

Tree Crop Farming System in rainfed system occupies 73 million ha in a belt that stretches through the humid forest zone of West Africa from Côte d'Ivoire, Sierra Leone and Liberia, to Ghana, Nigeria, Cameroun and Gabon, and in eastern part of Madagascar (Dixon et al., 2001). It accounts for 6 percent of the cultivated area in the region (10 million ha). The backbone of the system is smallholder industrial tree crop production (cocoa, coffee, oil palm and rubber). Food crops are interplanted between tree crops and are grown mainly for subsistence.

In traditional agro-silvicultural system crops have been always associated with exploitation of the natural vegetation of trees and shrubs. It involves inter-cropping (mainly millet and sorghum). Tree planting is not a significant activity but the people protect trees, shrubs, and bushes to meet their various needs including fruit, browse, building materials, fuelwood, nutrient cycling, gum, honey, and medicines. Agro-forestry techniques seem to hold in arid and semi-arid areas the most promise, because it addresses both the soil fertility problem and environmental protection. The use of woody nitrogen fixing species such as *Acacia albida*, *Glyricidia spp.*, *Leucenna spp.*, have the benefit to improve soil properties and protect soil against erosion. These techniques allow alley cropping which superiority over conventional continuous cultivation systems has been demonstrated in on-station and on-farm trials.

The paper presented by Tony Simons highlights in detail the role of TOF in agroforestry systems.

Fuelwood

In Kerala, the most densely inhabited State of India, a study estimated that of the total annual production of 14.6 million m³ of wood in the State, about 83% was from homesteads, 10% from estates² and only about 7% from forest areas (26.6% of the State area is under forest cover [FSI, 1998]). Trees outside forests met about 90% of the fuelwood requirements of the State. Fuel from coconut trees alone, including both wood and non-wood materials (pruned and fallen), constituted about 70% of the total fuelwood supply (Krishnakutty, 1990).

A study in Haryana State in India, an intensively cultivated state with about 3.8% of its area under forest land and only about 2% under actual forest cover (FSI, 1998), showed that farm forestry (trees along farm bonds and in small patches up to 0.1 ha) accounted for 41.2% of the total growing stock of wood, multiple tree rows along roads and canals for respectively 13%

² Estate: Kerala Forest Research Institute (KFRI) while conducting survey of trees outside forests in Kerala used two terms 'homesteads' and 'estates'. Homesteads include house compounds and farm lands where as estates include plantations of rubber, cardamom, coffee and tea (Krishnakutty 1990).

and 9.6%, village woodlots for 24% and block plantations of less than 0.1 ha for 10.6% (FSI, 2000).

This role is highlighted by the presentation delivered by Tara Bhatarai, focused on Asia cases studies.

Environmental Protection

The rapid growth of the cities, mainly in developing countries, is worsening the living conditions of poor people. The population in urban and peri-urban areas suffer from harshness of bad environmental quality due to air pollution, and lack of fuelwood and other wood and non-woods products. The issue is how to fulfil the increasing needs of the population while maintaining or improving the urban environment. Urban and peri-urban forestry could offer various potential benefits, including provisioning the urbanpoor with some forestry products, mitigating the ecological effects of urban sprawl, and improving the living environment in urban areas.

A case study paper focused on Europe urbanization issues will be presented by T. Randrup.

Farmers' income improvement

In Morocco, where forests are less than 5% of the land cover and other wooded lands only 7%, nearly 20% of the land may be occupied by trees outside forest, namely as wooded pasture (84%) and fruit tree plantations (12%) (rosaceae, citrus, olives trees, palm trees, walnut trees, fig trees, almond trees). Fruit production has an important place in the national economy (MADRPM, 2000). It is noted that even when a forest is largely destroyed, the carob (*Ceratonia siliqua* L.) is one of the few species traditionally conserved, as it is highly appreciated by the farmers for multiple purposes, providing both fodder and income from the sale of its fruit for export.

Some clear figures are highlighted by the presentation of Omar Mhirit in North Africa cases studies.

Non-wood forest products

In Sudan, the National Forest Inventory has undertaken a national land use inventory in order to provide area and volume statistics for planning at the sub-national (regional) and national levels (FAO, 1995). The inventory was designed to provide preliminary estimates of products other than the traditional fuelwood and timber, such as the amount of gum, fruit or nuts that can be collected and the distribution of non-timber species of interest (Glen, 2000).

All these products which are not often taken into account by the formal assessment methodologies of forest resources play great role on poverty alleviation, particularly in rural areas, in Africa, Latin America and Asia.

Some useful aspects will be presented by Peter Bailey.

6. Prospects of TOF

A case study carried out in Kenya, showed a useful policy measures to promote TOF in rural area. To promote TOF development by 1980s, Land tenure security has been used as a major pre-condition to enable extensive tree planting on farmlands. Today, empirical field evidence shows that there is an increasing trend of tree cover and species diversification on privately owned farms (Kiyiapi, 2000). Based on the present rate of increase in tree planting continues, farms will produce about 9.4 million m³ of wood in 2000 and about 17.8 million m³ in 2020. Their share of the total wood produced in the medium- and high-potential districts is projected to increase to 80% in 2020 (Forest Department of Kenya, 1994). A study conducted by Njenga *et al.* (1999) indicates that tree crops contributed 51%, 40% and 18% of the total the household income at the farm level respectively in 3 areas representing three areas different agro-ecological zones: Nyeri (high potential), Mwingi (medium potential) and Ngalange (low potential). The net result is that while natural stands of trees have declined there has been a corresponding increase in tree planting in much of the densely populated plateaux of Kenya. As natural forests are completely destroyed, greatly reduced or become inaccessible, the use of trees within agroforestry systems will help people to diversify production and their income and to protect themselves from shortages of fuel and wood. (KFMP 1994).

As pointed out by the key paper prepared by Karsenty, some emerging instruments linked to environmental conventions, especially the UNFCCC – climate convention, Clean Development Mechanism, could be good opportunities to promote (theoretically) TOF development by providing incentives, through small-scale and community targeted projects. One could be optimistic that TOF consideration will be evolving, slowly but surely in near future.

7. The way forward

Moving forward requires that following questions be addressed:

- How to assess TOFR and what is the status and dynamics of these resources ?
- What are the role of TOF towards combating desertification, agricultural production, biodiversity conservation and livelihoods improvement?
- What are the factors influencing TOFR conservation and development ?
- What is the relationship between TOF and forests?
- To which extent can trees outside forests contribute to decrease the pressure on the remaining forests and to improve their restoration and extension?
- How to built an effective information system and provide information on on-going institutional and policy approaches ?
- To which extent can trees outside forests contribute to decrease the pressure on the remaining forests and to improve their restoration and extension ?
- Which strategies can be put in place in order to promote TOF and their optimum use ?
- What are the main issues to be address now and in the future?

Expert Consultation on Trees Outside Forests

“Enhancing the Contribution of Trees Outside Forests to Sustainable Livelihoods”

(FAO HQ, Rome Italy, 26-28 November 2001)

Trees Outside the Forest: What do we know and why are we possibly interested?

By
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Summary

TOF constitute a resource that has received surprisingly little systematic and synoptic attention, and it is only in the last about five years that managers and researchers in the field of natural resources are “discovering” it as a general concept; though the topic has been treated in different “sectors” for quite a while, like in agroforestry and urban forestry. Most experts agree that this resource yet plays an important role with respect to a wide range of ecological and economical functions, and that it will be gaining importance in the future. However, it appears that this is largely an expert guess and not much hard data and information is out there. While forest inventories, also in the tropics, have a long history, and provide data on a regular basis, the tree resource outside forests appears to be largely ignored.

In this paper, we present and discuss this situation, and try to analyse the “why”. Geographical focus is Latin America, particularly Central America. This leads us to dealing with what we consider the major problems in discussions on TOF information, including questions that are seemingly basic such as terminology (definition, classification, conceptualization) or functions (economic, ecological, socio-cultural relevance), and others like the missing technical visions and management options for a large area development of that resource, and the missing legal framework in most countries.

We also discuss why we believe that TOF information should be an integral part of information provision in natural resources management, and for what this information is likely to be useful. As a conclusion, it is deemed useful to look at the “forest” resource not any more only in terms of “forest”, but in terms of “trees”. Some implications are discussed.

Trees outside the forest

Defining them and taking them into account

Dominique Louppe and Michelle Pain-Orcet

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The assessment of forestry resources

In order to assess the state of the world's forests every 10 years, the FAO uses precise definitions that are accepted and recognized throughout the world. Diverse inventories and statistics are established on the basis of these definitions. This universal base should make it possible to draw reliable comparisons between statistics in terms of time and space. Therefore, FAO proposes standard definitions for numerous terms, such as "soil degradation", "deforestation", "agricultural land", "wooded land", and "forests".

According to the FAO definition, a "forest" is a population of bushes, shrubby trees, and trees of over 5 m in height which covers (projection from the crown) more than 10% of a minimum surface area of 0.5 ha (FRA, 1998).

What about woody resources outside forests?

For several decades, foresters, environmentalists, and land planners have been aware that woody resources (over and above wood from trees) are not always extracted from forests. Hence, the development of the expression "trees outside the forest" or "non-forest trees" which conjures up a multitude of images. The fact that the expression can be interpreted in many different ways means that a precise definition is called for so that this "new" resource can be evaluated and included in "forestry" or "agricultural" statistics.

The first definition of trees outside the forest was proposed at the meeting in Kotka, Finland (Nyssonen and Ahti, 1996).

FAO organized two initiatives in order to draw this underestimated resource to the attention of decision-makers and planners throughout the world:

- A workshop from 21-23 September 1998 in Orléans (France) organized by IRD (Institut de recherche pour le développement, a French research and development institute) which brought together 40 specialists from different countries and institutions (Alexandre D.Y. *et al.* 1999);
- A report of the existing knowledge on trees outside the forest which was compiled by CIRAD-forêt: "*Les arbres hors forêt : pour une meilleure prise en compte.* (Trees outside the forest : Raising awareness)". This report was co-

published by FAO and CIRAD in November 2001 and made it possible to improve the definition of the term "trees outside the forest" (Bellefontaine *et al.*, 2001).

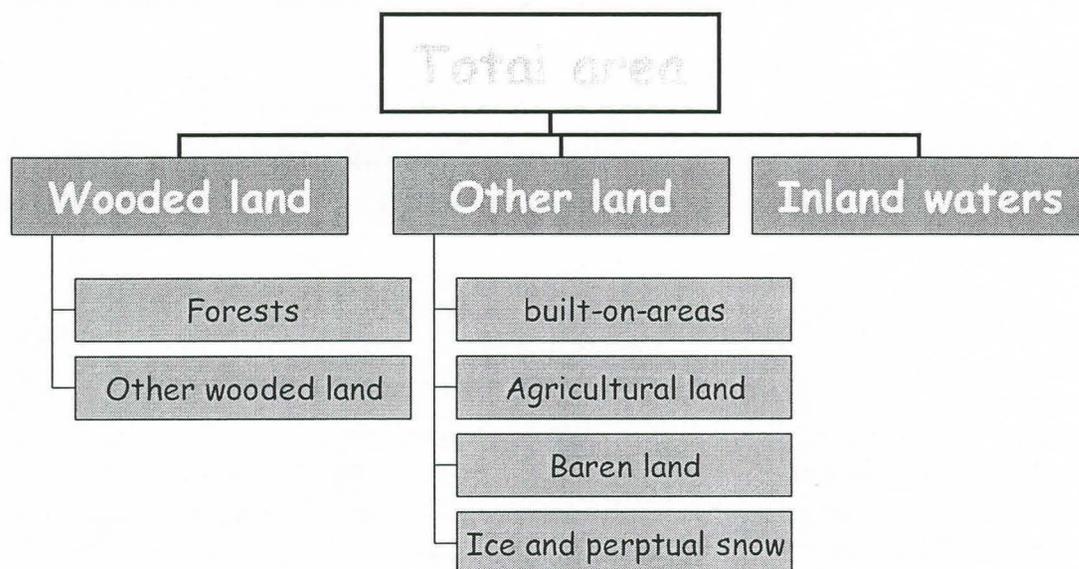
How can "trees outside the forest" be defined?

Here are several definitions which will help provide a framework for the concept of "trees outside the forest".

The term "emerged land" includes "wooded land", "other land", and "inland waters" (Figure 1).

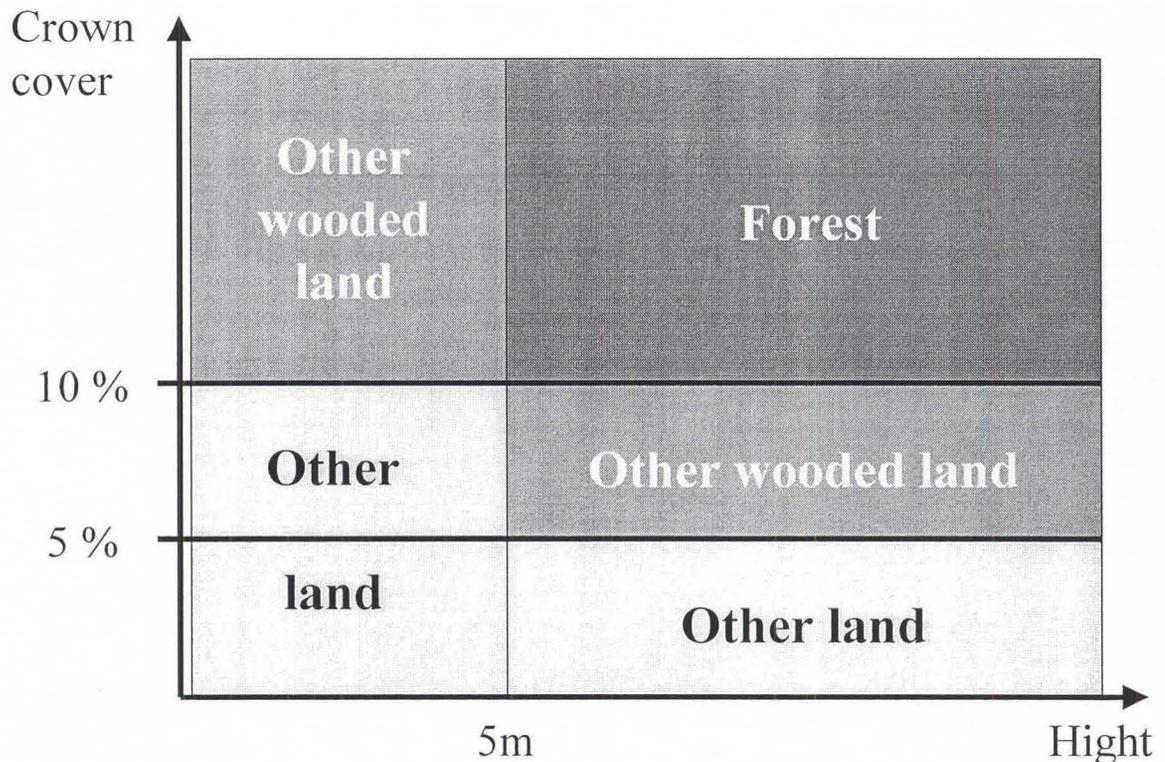
Figure 1

Classification of emerged areas and inland water



"Wooded land" can be divided into "forest land" (synonymous with "forests") and "other wooded land" (Figure 2). The term "other wooded land" relates to land of more than 0.5 ha where shrubs of up to 5 m high cover more than 10% of the surface area or where shrubby trees and trees of more than 5 m high cover 5-10% of the surface area.

Definition of forest, wooded land and other wooded lands (FAO 2001)



The term forest does not include land which is used primarily for agricultural purposes.

As a result, "trees outside the forest" fall into the category for "other land", which refers to land that is neither "forest" nor "other wooded land". In other words, they are on land where the woody crown cover is below 10% and less than 5 m high or below 5% and more than 5 m high. "Other land" also applies to all land of less than 0.5 ha where there is more than 10% woody cover, which includes linear formations such as shelter belts and riparian forests. Trees outside the forest can also be found on land that is used primarily for agriculture which is, by definition, excluded from "forests" but not necessarily from "other wooded land".

Improving the definition

The advantage of this definition is that it explains what is meant by trees outside the forest. It seems to be satisfactory when applied to natural environments where there has been little human interference. In the case of deforestation, it also includes the scattered trees left and the small groves that remain or are planted after agricultural clearing. However, it does not always correspond to our idea of trees outside the forest, particularly those found in very manmade countryside.

Thus, how should the wooded formations in the following examples be classified?

Oases and their date palms; woody species on fallow farm land which is sometimes agricultural sometimes forest; the grazing-orchards of France which primarily produce grass for livestock and not fruit or timber; linear wooded structures (windbreaks, straight plantations along water courses or roads, etc.); agroforestry parks and systems where shade trees and food crops or industrial produce (coffee, cocoa, tea, etc.) are intercropped, etc. According to the FAO definition, all these formations could be considered as forest formations. But are they really? Are they not rather trees outside the forest because of their uses?

The same question applies to agro-forests in Asia whose name would suggest that they be classified as "forests" although they produce agricultural products (which are also included in national agricultural production statistics). However, because of the very manmade nature of these "forest gardens" and the fact that they produce other products besides wood, many people do not consider them to be forests any more than fruit orchards.

In contrast, the sylvo-pastoral systems in Latin America (pasture and ranching, "*espinal*" in Chile, Mexican "*matorra*", the Argentinian plains, etc.), or Europe (the more or less dense stands of oak in the Spanish "*dehesa*" and the Portuguese "*montado*", etc.) could be classified as forest because grazing in forests is a traditional practice found all over the world.

Lastly, some sparsely wooded "forests" that are relatively untouched by Man in high mountain areas or arid zones or even some sparse formations of "miombo" in East Africa are naturally classified as "forests" or as "other forest land" if they are too sparse.

These questions show that the current definition of trees outside the forest, although very clear, is not entirely satisfactory. We do not consider that trees outside the forest can be adequately defined using criteria for the amount of crown cover, tree height, and plot size.

This explains why the definition of trees outside the forest presented in the FAO-CIRAD document includes the following categories of trees found in open environments:

- Scattered trees in permanent meadows or grassland.
- Permanent tree crops, orchards, and grazing-orchards, such as industrial fruit trees, coconuts, date palms.
- Trees in wooded agroforestry systems, such as coffee, cocoa, trees in home gardens.
- Trees in urban environments and around infrastructures, such as parks and gardens, around buildings, along streets, roads, water courses, and canals.

Despite these additional details, some questions still remain. For example, the definition of "forests" includes shelterbelts and windbreaks that *are more than 20 m wide and more than 0.5 ha in size*. In the definition of "trees outside the forest", only shelterbelts of *less than 0.5 ha and less than 20 m wide* are included. If this is to be

coherent with the given definition of forests, it would be better to say *less than 0.5 ha or less than 20 m wide*.

The definition of trees outside the forest still needs to be more specific. The seminar which is currently underway (26-28 November 2001) and the Comité des Forêts (COFO, a forestry committee), which meets every 2 years, could provide FAO with the opportunity to address the issue of trees outside the forest. It is these assemblies that ultimately decide whether or not to modify the current definition of "trees outside the forest".

Nevertheless, we would like to suggest that an additional criterion—which already appears in the definition of forests—be considered, namely the principal land use. The definition of "forests" *excludes land which is used primarily for agricultural purposes*. Yet, this definition does not specify the point at which land is considered to be used for agricultural or pastoral purposes. If agricultural production is extensive and temporary, for example shifting cultivation using slash and burn, should the land be considered agricultural? We do not think so. Instead, we consider that if land is to be classified as agricultural, then the agriculture should be intensive and sedentarized to a certain extent. In these circumstances, if the trees are an integral part of the cropping system, we think that they should be considered as trees outside the forest. Even woody species grown on short-term fallow (5-7 years) should be included in this category if they are part of an intensive agricultural system where the length of cropping is longer than the fallow period. The same applies to trees in pasture if the pasture is used extensively and managed using fire. In other words, these trees should be included in the forestry category or as trees outside the forest depending on whether they cover more or less than 10% of the land.

The definition of trees outside the forest should, therefore, take into account the vegetation's evolution which is linked to how manmade and domesticated the environment is. Land clearance drastically reduces woody cover. After this phase of depletion, we have observed that people generally reconstitute the forest cover, at least in part. This new cover is often very structured spatially. The forest, as such, often appears to be like a long-term fallow, like real forestry plantations or preserved natural forest areas. Beyond this, the trees are in the middle of cropping or grazing land, in other words on manmade land where they have many and varied functions. Therefore, these trees have been tamed, indeed domesticated. Trees which are on intensive agricultural or grazing land are not usually included in forestry statistics. The same applies to trees in urban areas. Even when their cover exceeds 10%, they are still considered to be trees outside the forest.

The difficulty of finding a simple definition for a tree outside the forest stems from the importance that it represents for different human societies and the economic role that it fulfils. Therefore, the tree outside the forest can no longer be ignored by politicians and decision-makers. We make several recommendations below—which are not exhaustive—so that these trees can be taken into account on every level, particularly at the decision-making level.

Recommendations

Defining, accounting for and diversity

The national and world assessments of woody resources are incomplete because, in general, they only include areas qualified as forest and exclude "trees outside the forest" found in rural and urban areas. The current term "trees outside the forest" does not give a sufficiently clear illustration of the diversity of this resource which straddles different sectors, fields, and disciplines. Thus, the concept will inevitably develop as the resource is taken into account by land planning. The proposals to improve the definition, include local specificities, and facilitate comparisons between countries or ecosystems have been presented here.

For planning, we recommend that trees outside the forest are included systematically in the assessments of woody resources. A discussion is required on a national and global level so that trees outside the forest can be included in an unequivocal classification of land that is both pluridisciplinary and multi-sectorial. In this context, the definition of "forests" will undoubtedly have to be revised. It is important to ensure that the definition for trees outside the forest is the result of a broad discussion between stakeholders and users.

National policy, international discussion and agreement

In many countries, people use trees outside the forest spontaneously even though there are no national policies to encourage them to do so. The role of these trees is not officially recognized despite the fact that they have important functions. In addition, international conventions make no mention of this category although they do refer to other ecosystems.

On a national level, a clear coherent policy that acts as an incentive in terms of trees outside the forest is advisable to ensure that land planning is truly integrated. On an international level, trees outside the forest should be included among donors' major environmental concerns, conventions, and policies.

Social, economic, and environmental contribution

Trees outside the forest are characterized by their relationships with Man and society. They often provide a vital contribution to the needs and incomes of rural and urban households. The sustainability of these tree systems is ensured through diverse management practices. However, there are gaps in our knowledge on the dynamics of this resource, particularly in terms of the relationships between "trees outside the forest, Man and society, agriculture, and the environment". The economic, social, and environmental contribution made by these wooded systems is not fully recognized. Disperse, fragmentary and empirical information is already available for numerous countries. A report appraising the real contribution of trees outside the forest in terms of the global supply of services and products is often inadequate.

Programmes for food security and the well-being of people can no longer ignore the resource represented by trees outside the forest. National policies should continue to manage these trees in a flexible way. Integrated regional and land planning practices should be varied and adapted to the different local conditions and should evolve in line with social and cultural changes. New economic tools should be tested. A summary and an analysis of existing knowledge are vital for outlining a policy to encourage "trees outside the forest".

Improved knowledge, extension, and training

We do not know enough about the role and function of trees outside the forest to be able to improve their management. This explains why existing training courses are still very specific and disciplinary (for example, preliminary pruning of fruit trees). Similarly, extension programmes only address certain—often very sectorial and thematic—issues and fall short of users' expectations.

We need to further our understanding of how trees outside the forest function within production systems. In order to do this, support is needed so that research programmes can be developed to meet national needs. Training and extension programmes should be developed by using a more systematic approach that takes into account people's needs and concerns.

Evaluating the resource

The available qualitative and quantitative data on trees outside the forest is very fragmentary and often only represents the situation on a local (rarely regional) level. Until now, most assessments have been carried out on manmade and agroforestry areas. The evaluation of the extremely diverse products is not very reliable. Therefore, comparing inventories is not easy.

The methods used to conduct the inventory of forests do not seem adapted to scattered resources of this kind. The evaluation of trees outside the forest is complex because it requires a great deal of information.

It is important to define the objectives of the evaluation clearly. These should address the needs and interests of the stakeholders concerned and should be taken into account when the results are applied. New inventory methods, particularly inventory plans, should be tested on different types of trees outside the forest and on significant areas before being applied on a larger scale. This type of evaluation should also include socio-cultural and economic aspects which are essential for maintaining the resource and ensuring that it is well managed.

Conclusion

On a global level, trees outside the forest represent a significant source of wood production and other non-woody tree products. Neither the resource nor its productivity have been quantified. This is partly because there is not a sufficiently precise definition of what should be surveyed and, partly, because of the difficulty of conducting an inventory of such a diverse and scattered resource.

The existence of this resource, which has long been ignored, has disproved many alarmist theories about accelerated desertification and the systematic disappearance of fuelwood. It is important to recognize and raise awareness of this resource. It is also essential that policies take it into account so that environmental management can be improved for people's benefit.

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TREES OUTSIDE THE FOREST: POLICY AND LEGISLATIVE FRAMEWORKS: THE INFLUENCE ON THE DYNAMICS OF RESOURCES RELATED TO TREES OUTSIDE THE FOREST

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Paper Submitted to the Expert Meeting on Trees Outside the Forest; 26-28 November 2001

Abstract

Local communities and the government derive enormous benefits from trees outside forest (TOF) with over 70% of all timber produced in the country since the 1980's consistently coming from TOF. It is estimated that timber resource within TOF are being overexploited at a rate of 2.5 times the annual allowable cut (AAC). Over 50% of exploitation of timber from TOF is illegal mainly due to conflicts arising from the lack of involvement of farmers and local communities in the management of TOF. Conflicts arise out of the fact that farmers are the main custodians of TOF, whilst management and utilisation rights are vested in the State, which makes protection and control of exploitation of TOF. Other factors for the poor control of TOF harvesting include weak public and local community institutional structures to implement effective and sustainable TOF resource management.

The lack of control of resources has arisen largely because prior to 1994, the TOF policy encouraged the "controlled liquidation" of commercial TOF, especially timber before farmers clear their lands for farming in order to reduce wood waste. This policy of "controlled liquidation" of naturally growing timber on farms was to be undertaken together with a vigorous reforestation programme within farms based on the principle of compensatory planting. In this regard district felling quotas (DFQ) of TOF, which set the total number of trees to be felled within an administrative district each year, was developed and implemented. These district quotas do not include trees destroyed by farmers during farm establishment. However, the compensatory plantings (equal to district quota plus trees lost during farming) would take into consideration trees lost due to human interference.

Within the last five years, the government has adopted a more comprehensive approach to TOF management, which involves the collaborative management approach. The management strategy involves the organization of farmers and land-owning individuals and chiefs within a District Management Area (DMA) to draw up sustainable District Forest Development Plans (DFDP)¹ for their area with the support of specialists from the Forestry Commission. To this end the government has put in place a programme aimed at building the capacity of local communities to play a full role in the management of TOF resources.

¹ The District Forest development Plan (DFDP) is a management plan for TOF within a defined area. The DFDP will outline the broad categories of land use areas based on the goals and objectives of relevant stakeholders and the District Assembly (District Political Administrative body), indicate available TOF resources and the project demand for these resources.

A review of the collaborative management strategy is currently being done to ensure that factors such as tenure and resource use rights, social equity and efficient distribution of costs and benefits and integrated community development to alleviate poverty are effectively incorporated in the management strategy to achieve their desired impact.

Introduction

Ghana covers an area of approximately 23.9 million km² and the total population was estimated to be about 18.4 million based on the 2000 Population Census, thus giving a population density of about 0.75 ha⁻¹. The population growth is between 2.6-3.0, while the fertility rate is 6.0. About 45% of the population is below the age of 15 years. Almost 60% of the population live in rural communities and the remaining living in urban centres. Agriculture is the most widespread occupation in Ghana with over 60% of the working class population being farmers.

Per-capita gross national product (GNP) and gross domestic product (GDP) are US\$420 and US\$452 respectively. Agriculture contributes approximately 50% of GDP (World Resources Institute 1999). Industry accounts for 15% while services contributes the remaining 35% of GDP. The forestry sector's contribution to GDP is estimated to be about 6%. The Ghana Living Standards survey (1988-92) indicates that about 31% of the Ghanaian population is poor. Rural areas, which contain about 66% of the country's population accounts for almost 75% of the population of the country which is below the poverty line (MLF 1997).

The forestry sector plays an important role in the socio-economic development of the country. For example, wood fuel consumption for domestic and industrial energy uses amount to about 16 million m³ valued at approximately US\$250 million annually. In addition, the timber industry earned \$175.24 million from the export of wood and wood products in year 2000. The forestry sector contributes about 6% to gross domestic product (GDP) and provides direct employment to over 100,000 people and indirect employment to over 2.5 million Ghanaians.

Available records from the Ghana Forest Service show that about 70 percent of all timber produced in the country has consistently come from trees outside the reserved forest since the 1980's. The high level of timber exploitation and the uncontrolled agriculture expansion have resulted in rapid deforestation of trees outside the forest (TOF). This has happened because there are no legal restrictions to felling TOF during land preparation for farming.

One of the major tasks facing policy makers and forest managers in Ghana is evolving an effective management system for TOF to ensure a balance between the sustainable production of tree resources and the maintenance of agricultural productivity within an area with a mosaic of forests and farmlands. Secondly, protection, biodiversity conservation, harvesting controls and husbandry decisions that are central to SFM on TOF came only under the ambit of the Forest Services Division (Government Forest Service) in November 1994. Previously, farmers had direct management control over all TOF, even though they did not have rights to utilise timber trees outside forests.

The Forest Services Division (FSD) have since 1994 been trying to develop a sustainable management system for TOF involving all stakeholders. Of greatest concern for the professional foresters are the lack of very cordial relations between some field forestry officers and the local forest users. This situation has come about

because in the past FSD was regarded by the communities more as a regulator of their activities and not as a partner in the development of the forest resources. As a result, there was very little cooperation between the FSD and the populations living near the forests and this posed a serious threat to the future development of forest resources on reserves. Similarly, the big problem for the FSD in the management of TOF not how to put new areas under management, but how to stop farmers from wantonly destroying valuable timber trees on their farms and encourage them to tend them instead.

The lack of farmer participation in the active management of TOF has been their marginalisation from forests and economic trees. Farmers are the main custodians of the forest environment, they work among trees and decide to either preserve or clear TOF during land preparation for farming. The future of TOF depends on how farmers manage or mismanage their farmlands. The Government therefore decided to develop a collaborative management of TOF with the active participation of farmers and local communities in order to address the rapid removal of TOF and to sustain their utilisation.

Under the collaborative management of TOF programme, the potential for communities to actively manage their TOF, and the resources FSD might need to facilitate it have been intensively investigated in a number of pilot sites. Many other possibilities is being explored such as the provision of a planting grant or loan facility to enable farmers to plant and tend timber trees on their lands.

Nature and Extent of Trees Outside the Forest

The first national inventory covering commercial TOF, with emphasis on timber trees, was undertaken by the Forest services Division (FSD) of the Forestry Commission between 1996 and 1997. The inventory covered plots totalling 500 ha of the four major vegetation zones of the country.

The results of the inventory indicate that most of the tree resources are found within the following areas:

- Remnants of old growth forest
- Secondary forest regenerating from fallow areas
- Riparian forest strips ranging from 5-50 m wide along most streams
- Trees on farms
- Small plots of plantation areas in the farm mosaic

The highest density and number of trees are found in pockets of small continuous closed canopy forests (Fig. 1). This is followed closely by degraded secondary forests or farm fallow areas invaded by *Chromolaena odorata* and *Theobroma cacao* (Cocoa) growing areas. However, if the tree resources of food crop farms and fallow areas are combined, it becomes clear that there are more economic trees on farms than in natural forests outside forest reserves. The TOF situation in the country indicates that there is the need for consultations of farmers in the management of trees and forests (Forestry Department 1999).

Estimated Number of Timber trees in TOF by Land use type

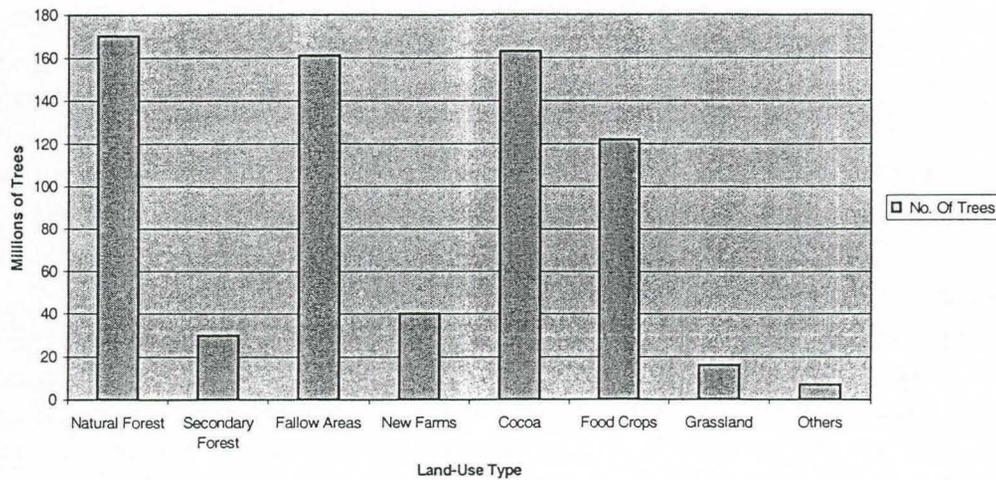


Fig. 1: Number of timber trees within different land use types based on data from National commercial TOF inventory

Available records from the Forest Product Inspection Division (FPID) and Forest Services Division (FSD) show that about 70 percent of timber on the average has consistently been produced from TOFs (Table 1). The present rates of exploitation of TOFs certainly cannot be sustained and since on-reserve harvesting cannot be increased in the short-term it would appear that total harvest rates would have to fall at least until the TOF harvest can be sustainably secured.

Table 1: Timber Production from On-Reserve and TOF in 1996

Source of Timber	Volume of Logs Produced	Percentage of Logs Produced
Trees Outside Forests	820,547 m ³	70.5%
Trees Within Forest Reserves	282,521 m ³	24.3%
Unknown Sources	61,244 m ³	5.2%
Total Timber Volume Felled	1,164,292 m³	100%

Policy and Legislation on Trees Outside the Forest

The first official forest policy of Ghana which was formulated in 1908 was directed primarily to the preservation of a sufficient area of forest-covered land so distributed as to protect the water supply and to ensure the maintenance of the humid forest type of climate which was an essential factor in the growth of *Theobroma cacao* (cocoa), *Cola nitida* (kola) and other crops upon which the prosperity of the colony depended (Annual Report on the Forestry Department, 1929-1930). This policy did not emphasise the conservation and sustainable utilisation of TOF probably because forests were abundant.

Prior to independence in 1957, the Colonial Administration addressed the issue of TOF only in relation to the development of a revenue base for Chiefs and Traditional Authorities by securing their rights to hold allodial title to all economic TOF and thus the right to accrue revenue from royalty payments. However, after Independence in 1957, state control over forest resources increased and was further entrenched by the passing of the Administrator of Lands Act, 1962 (Act 124). The Act conferred to the state the management of stool lands and the grant of timber rights amongst others. All timber trees were vested in the President with the passing of the Concessions Act. The title however remained with the stool landowners.

The provisions of Section 16 of the Concessions Act, 1962 (Act 124) make timber or trees on any other lands also vested in the President. The forest Ordinance is made applicable *mutatis mutandis* to any land outside forest reserve for which rights relating to timber or trees have been or are expected to be granted. Generally, the management of all forests is made subject to the Forest Ordinance. For example the provisions establishing prohibitions, restrictions, impositions or concerning settlement of customary rights could apply to any forest areas. The laws make FD the management authority of the outside reserve and the lands commission being responsible for collection of rents and revenues and the disbursements of revenue done through the Administrator of stool lands (FD undated).

Also prior to independence a new forest policy was formulated in 1948 to maximise the utilisation of TOF prior to conversion to agricultural lands. During the pre-1970 era total timber exploited were very high and the large contributions from TOF represented the clearance of land for agriculture. The general economic trends in the country from 1970 to 1980's resulted in the low rates of exploitation's from outside reserve whilst the bulk was contributed by the introduction of salvage of over-mature trees in most productive reserves. Since the 1980's the majority of trees exploited have come form off-reserve areas. This is probably because the Structural Adjustment programme initiated by the Ghana Government and supported by the International Monetary Fund (IMF) led to a revival of the timber industry resulting in an increased rate of exploitation. Incidentally, during the same period a Forest Resource Management Project (FRMP) supported by the World Bank and ODA, UK. brought production from on reserve to sustainable levels. The resulting impact of these two programmes was that following sustainable exploitation on reserve, the industry turned to off- reserve areas for the bulk of their increased wood requirements.

A new Forest and Wildlife Policy was formulated in 1994 to ensure that there was a major shift from the policy of "liquidation" to sustained management of TOF and other resources. This is highlighted by clause 5.3.2, which encourages the efficient management and utilisation of unreserved forests based on the regulation of uncontrolled harvesting, expeditious collection of relevant fees and conformity with criteria for sustainable resource management.

Other frameworks that have been adopted by the 1994 Forest and Wildlife Policy to ensure sustainable management of TOF include:

1. On the resource, the policy advocates for :-
 - a. Inclusion of unreserved forest resources under state management even though ownership of the resource still resides in traditional owners and individuals
 - b. Promotion of agro-forestry initiatives
2. For stakeholder participation, the policy recognises or provides for:-

- a. Encouraging communities to undertake protection initiatives
 - b. Widening of co-operation and promotion of dialogue with the private sector
 - c. Promotion and implementation of awareness programmes
3. On institutional frameworks, the policy seeks to:-
- a. Introduce competitive allocation and harvesting of timber resource
 - b. Review legislation and administrative arrangements

Nsenkyire (1997) notes in a comprehensive review of the 1994 Forest and Wildlife Policy that the policy sets a good framework for the sustainable management of TOFs.

Tenurial Arrangements for TOF

Land Tenure

Land on which TOF is found is either communally or privately owned and the government has no direct ownership functions for such lands. Individuals and families acquire land with the consent of the Traditional Authority. However, the Traditional Authority cannot deny a member of the community the right of access if the land has not been occupied for some time. Land tenure systems, however varies throughout the country and depends on the customs and traditional political organisation of the community.

Generally, immigrants and tenant farmers have restricted rights to the use of acquired land. Although customary laws do not prevent immigrants and tenant farmers from planting and managing TOF, land owners do not encourage them to do so because the long production period of trees and the lack of appropriate documentation of land ownership, increases the security of land rights for immigrants and tenants when trees are planted (Agyeman 1994). They can use the farm for growing food crops but not tree or cash crops unless the landowner has specifically agreed to it.

Fragmentation of land through inheritance practices is also a major tenurial problem influencing the sustainable management of commercial TOF. Farmers with less tenuous rights to land are reluctant to manage TOF since they can loose rights to some TOF as a result of fragmentation of land through inheritance. Therefore unless inheritance and land tenure systems which lead to fragmentation of land and conflicts between tree and land tenure are addressed, individual with less tenuous rights to land in some areas, including women, tenants and strangers may not participate readily in the conservation and sustainable utilisation of TOF.

Tree Tenure

Tree tenure systems are very variable in Ghana and depend upon

- i) How economic the tree is
- ii) Status of land (communal or private)
- iii) Land availability
- iv) population density

- v) status of individuals (whether chiefs, indigenes, strangers, landlords or tenants) and length of tenure in the community.

Generally, in almost all societies in the country planted and naturally grown TOFs are not regarded as part of the land and are not covered by land sale. Trees may be purchased or inherited separately. Title to TOF, especially economic ones, vests in the holder of the paramount interest to the land on which they grow (Agyeman 1994). Naturally occurring timber trees although belonging to the landowners are vested in the President. It is from this vestiture that the regulatory powers used as the basis for off-reserve management are derived.

Tree tenure systems are different for planted compared to those naturally occurring and for trees on family and communal lands². Individuals cannot harvest TOF and food crops that have been planted on communally owned land without the consent of the community. The communities normally do planting and maintenance of TOF on communal land. On the other hand, individual members of the family have secure rights to TOF on family land. However, the security of tenure is much stronger for planted trees than for naturally occurring commercial trees like timber, which is vested in the State.

With respect to the tenorial differences between naturally occurring trees on family and communal lands, most communities allow the collection of medicine, fruits and fuelwood for personal use from communal lands by members of the community, however these cannot be sold for profit. On the other hand TOF on family land are the exclusive property of the family members. Generally tenorial rights are affected by the use of the tree and the more economic a tree becomes, the greater the tenorial restriction on tenants and strangers (Agyeman 1994).

Tree tenorial restrictions in some parts of the country have impacted negatively on the community participation in TOF management. Other factors impacting negatively on sustainable TOF management include the failure of the government to take adequately into account the traditional tenure systems when developing forest policy. This is necessary in order to ensure the cooperation of the community. However, it is also possible that the traditional tree tenure systems may no longer be appropriate, or sufficient, to protect TOF as cultural changes occur and population pressures increase. If the tree tenure systems in force in the community were ones that facilitated sustainable management of TOF, or if the community's usufructuary rights with regard to TOF were more secure, then trees would have been better protected by local communities.

Tenorial Conflicts and their Impact on TOF Management

In several communities in the country land and tree tenorial rights are vested in different parties. In some cases the family retains the right to economic trees even when the land in question has been given out to others or sold. In these societies, all economic trees, such as cocoa, palm and citrus belong to the planter (both landlords and tenants) and are inheritable. The land on which these trees occur are also separately inherited which leads to conflicts (Agyeman 1994). The importance of land, and the fact that claims to land ownership is through often inaccurate oral

² Communal land is defined as land, which does not belong to any individual or family and is considered the property of the whole community.

history, has resulted in a high number of land cases pending before the law courts. According to Meek (1957) the separate ownership of trees and land may interfere with the cultivation rights of new landowners, or tenant farmers, when there are many trees leading to direct land use conflicts arise.

In the present system, all rights to naturally occurring timber trees are vested in the government. However, if a farmer plants commercial timber trees on his farm and they reach maturity it belongs to him. On the other hand, generally trees planted on communal land cannot be owned, harvested or inherited by individuals. They are communally owned. This has led to a situation where individuals are not willing to or are prevented from managing TOF on certain lands.

The main points to note with reference to conflicts over land and tree tenure are:

1. The right to use TOF and land can be held by two different parties, which may result in conflicting interests
2. Some indigenous laws and customs do not encourage all people (stranger and tenant farmers particularly) to plant, use and own TOF.
3. TOF on communal lands may be regarded as public property, which prevents tree planters from exercising complete control over their use.
4. Only certain TOF of low economic value are likely to be planted as individual rights appear to decline as the value of the planted tree increase.

Underlying Causes of Degradation of TOF

Wildfires

Fire is at present the most important cause of degradation of TOF in Ghana. The incidence of fire has been found to increase with forest disturbance caused by logging and thinning operations (Swaine *et. al.* 1997).

The annual loss of revenue from merchantable timber to fire is currently estimated at \$24 million. Wildfire has been estimated to cause an annual loss of 3% of GDP during the last fifteen years (Bank of Ghana 1995). Fire has severely reduced not only the productive capacity of the forests affected but has also had major impacts on the other benefits of forest cover, including water supply and quality, soil fertility and biodiversity (Hawthorne and Abu-Juam 1995). Ground fires in particular, may have serious consequences for degradation of TOF because they are more damaging to small plants near the ground surface (Orgle 1994).

Before 1983, fires were common in the savannah zone but not the high forest zone of the country. However, the severe drought and fires of 1983 and 1987 caused such damage that the affected TOF areas within the high forest zone of the country were more prone to subsequent fires and suffered greater damage. Logging in affected TOF areas also increased the susceptibility of TOF areas to fire. The combination of these factors has converted the forest from generally aggrading systems to systems of progressive degradation (Swaine *et. al.* 1997).

There is an urgent need to develop an understanding of causes and effects of wildfires in TOF areas in order to find effective means to prevent fires in the country. In this regard the Ministry of Lands and Forestry of the Government of Ghana has initiated a broad programme with the support of the Royal Netherlands Government (RNG), aimed at the prevention and control of forest fires.

Poor Agricultural Practices

Majority of Ghanaian farmers use shifting cultivation/rotation cropping system of farming. Under this system, a portion of land is cleared (using the slash-and burn method) and farmed for two to four years and then fallowed for a period for the land to regain its fertility. In time past, the fallow period was about twenty years during which time the farmer would be cultivating other areas. Increased population pressure has reduced the fallow period to one to three years, which is inadequate for soil rejuvenation. This has led to a situation in which the land does not revert to its former fertility before it is cropped again. It has resulted in soil degradation and reduced per-hectare crop yields, one of the major problems facing agricultural production and consequently an encroachment on TOF areas to attain and maintain the level of food production, which will satisfy the increasing population. A large proportion of degradation of TOF is attributed to shifting cultivation. This, coupled with other factors like the search for fuelwood and timber exploitation have reduced the total area with TOF.

High Population Growth

High human population growth and the increasing dependence of people on TOF has resulted in increasing deforestation rates. Although increased utilisation of TOF promotes socio-economic development, it is important to note that the unsustainable utilisation of TOF has in some instances led to a spiral effect. It has been observed in several places that degradation of TOF results in immediate increased benefits to local communities but in the long term leads to a high incidence of poverty. Thus corresponding appropriate sustainable TOF management strategies would have to be developed and implemented to ensure that increased harvesting of TOF does not lead to degradation of the environment.

Logging

Logging not only reduces the standing stock in TOF areas but also damages the residual stand. The incidence of the most severe form of logging damage in TOF areas increases with felling intensity (Agyeman *et. al.* 1999). It has been noted that on average about four commercial timber trees between 10-50cm dbh are completely destroyed for every 100m of skid trails constructed during the logging process. The high tree damage may be related to the large sizes of the skid trails and haulage roads, which are made during extraction.

Management of Trees Outside Forests

Prior to 1994 there were no effective management systems for TOF. The procedures in place supported the old 1948 Forest Policy of the controlled liquidation of commercial TOF, especially timber prior to land clearance and by this time the regulation of timber exploitation off reserve was muddled.

In order to address the problems of TOF management, "Interim Control Measures" on exploitation and transportation of TOF was instituted in 1995. These measures, which involved local community involvement in monitoring and management, was meant to ensure that social responsibility, environmental and ecological issues were

implemented in order to ensure sustainability of wood supplies from TOF (Gronow 1997). The second step under the “Interim Control Measures” was a shift from the policy of “liquidation” to sustained management of TOF. This is highlighted by clause 5.3.2 of the 1998 Forest and Wildlife policy which encourages the efficient management and utilization of TOF based on the regulation of harvesting, expeditious collection of relevant fees and conformity with criteria for sustainable resource management.

In order to consolidate the gains made by the implementation of the Interim Measures, a Timber Resources Management Act, 1997 (Act 583) and an accompanying Timber Resources Management Regulations, 1998 (L.I 1649) was enacted. Timber Utilisation Contracts (TUCs) with social responsibility agreement (SRA) to make contracts and local people responsible enough for the protection and management of TOF have been instituted in the Forest Resources Management Act of 1998 (Act 543).

Currently, the approach that has been adopted for the sustainable management of TOF is different from that for reserved forests. Whereas timber resources can be harvested, based on the annual allowable cut (AAC), in perpetuity in reserved forest, those of TOF is based on the principle of compensatory planting, enhanced natural regeneration in forests with a high degree of cover, and protection of fragile ecosystems and rare and endangered plants. The compensatory plantings, involving the establishment of plantations and trees on agricultural lands, are similar to the carbon credits being developed in some countries. District felling quotas, which set the total number of trees to be felled within an administrative district each year, have been developed based on the results of an off-reserve timber resource inventory in 1996 (Planning Branch 1997). These district quotas do not include trees destroyed by farmers during farm establishment. However, the compensatory plantings (equal to district quota plus trees lost during farming) would take into consideration trees lost due to human interference.

Environmental control is being maintained by best practice codes through Timber Utilisation Contract (TUC) plans or Timber Operations Specifications (TOS), which are required of concessionaires for the protection of watersheds, riparian zones and hilly areas. Maintaining and enhancing the socio-economic needs of the local communities is being achieved through the implementation of a Social Responsibility Agreement (SRA) between contracts and local communities; benefits may include, employment, poverty alleviation, flow of benefits, and the degree to which social, culture and spiritual needs of the people are met.

Maintenance and enhancement of biological diversity in TOF areas is also being achieved through defining strict and protected dedicated forests, protection of endangered species and use of indigenous species in mixed plantations. Control systems cover Forestry Commission control mechanisms within TOFs. These include a range of things such as the monitoring of the TUC operation plans, felling permits and compliance with social responsibility agreements.

TOF management structures are currently heavily dependent on the support and active participation of landowners and local communities since they control the resource. The management strategy involves the organization of farmers and land-owning individuals and chiefs within a District Management Area (DMA) to draw up sustainable District Forest Development Plans (DFDP) for their area with the support of specialists from the Forestry Commission.

However, it is worth mentioning that the effectiveness of TOF management have been hampered through the use of inappropriate prevailing legislative framework in controlling illegal fellings within TOF. Currently laws are being reviewed and updated. In some cases the laws are contradictory or circumstances have changed so much since their promulgation that they are no more relevant. These laws require immediate attention for effective managing of the Forestry Commission.

Collaborative Management and Decision-Making Process

Local community involvement is important because in Ghana, the land and forest tenure systems are unique. Local communities represented by Chiefs or stools own all forests in the country, including the TOF. However the forests are managed by the Forestry Commission on behalf of the landowners who have customary and moral use rights of forest resources, which are known as Domestic Use Rights (DURs).

In view of the strong interest and rights of local communities in forest resource management, the Forestry Commission has modified the focal point of its management system to ensure greater consultation with stakeholders, especially local communities that are dependent on the TOF and are willing to ensure its maintenance. Thus the focus of TOF management in the country is shifting from a government-led system to a community-government collaborative management approach. The current collaborative approach involves consultation, needs assessment, investigation, synthesis and consensus building aimed at ensuring equity and the fair distribution of benefits and efficiency in the execution of forest management prescriptions.

The overall objectives of the collaborative management approach are as follows:

1. To promote and sustain TOF use and value through the development of collaborative management initiatives involving the Forestry Commission and rural people. The programme was designed to examine the potential for collaborative management for:
2. To provide the government of Ghana with information and analysis to inform policy making on a wide range of land use and natural resource management issues of relevance to sustaining TOF.
3. To provide the Forestry Commission with the information needed to demonstrate the importance and value of TOF to rural livelihoods
4. To identify and develop local level initiatives to counter environmental problems such as fire, decreasing soil fertility and local watershed protection.
5. To identify and develop local level initiatives to sustain and improve the value of TOF.

The Collaborative Forest Management (CFM) approach adopts the learning-up process, which concentrates on devising effective strategies at the conceptual stages, reviewing the effective phase to make it more efficient and finally expanding the lessons learnt to cover the target area. The programme combines action research with local pilot initiative in collaborative management of TOF. The collaborative programme emphasizes the development of systems of information gathering and analysis on TOF use, both for the purposes of local level planning, and in order to demonstrate the value of TOF to local people. It stresses that the value of the TOF should not be seen only in terms of its contribution to the national economy through

timber revenues, but also through its value to local populations as a source of income and subsistence produce, and critically as a 'buffer' resource that can be drawn on by the vulnerable in times of particular hardship and crisis.

Consultations have been done at both the strategic³ and operational levels⁴ of forest management. Workshops and educational programmes have been held in a number of communities to raise the awareness of local communities and also to secure their views on forest management. Reserve management planning sessions have also been evolved on a pilot basis through which communities in conjunction with the Forestry Commission jointly undertake reserve management planning.

The problem is that even though a comprehensive collaborative TOF management strategy has been developed, it is still largely at the pilot stage. The main problem facing the forestry authorities is how to integrate local communities into planning and management and still maintain a profitable and export-oriented forestry sector. In order to address this problem, the Ministry of Lands, Forestry and Mines (MLFM) will soon establish a FOREST FORUM (multi-stakeholder group) to adopt and implement collaborative programmes to resolve the problems affecting the forestry sector. The scope for collaboration in forest management across such a broad landscape will involve a great diversity of people; groups of poor rural NTFP collectors, chainsaw operators and sawmill owners, local politicians, traditional chiefs.

Overview of the Potential, Constraints and Opportunities for the Promotion and the Economic Valorisation of TOF Resource

Potential and Opportunities for TOF Management

Ghana is faced with future export and domestic demands on local timber resources far in excess of sustainable limits. If these demands were to be realized only from existing local resources, the resultant shortages in a few years would signal the demise of the industry, not to mention the punitive international market sanctions that would take effect since our timber products would not qualify as "*sourced from sustainably managed forests*". Consequently, should timber exploitation of TOF continue at the present rate (70% of total timber exploitation), over the next ten to twenty years there will be a significant reduction in the economic contribution of TOF in Ghana. Export earnings could fall to zero (or even become negative as wood is imported to meet domestic demand), tens of thousands of jobs could be lost, and the non-timber values of the forest would be eroded.

It is therefore crucial that all stakeholders, including the government, timber industry, land owners and farmers, respond favourably to the policy reforms and that the desired changes are effected in the shortest possible time. First of all, a framework of competitive allocation of commercial rights to TOF, increased royalty rates and improved industrial standards need to be enforced. These actions need to be integrated with a re-tooling of the timber industry to improve efficiency and

³ Operational planning defines work programmes to be undertaken in order to achieve the strategic objectives. It ensures that resource requirements in terms of labour, transport, materials and funds are available at the right time.

⁴ Strategic planning is a mechanism for ensuring that local forest resource management is carried out in accordance with the requirements of National Forest Policy in Ghana.

increase utilization of available timber supplies from TOF. At the same time, there should be greater use of logging and mill residues, which constitute about 50% of utilisable volume of timber, and significant improvement in output and quality of wood products. Secondly, there is the need for tighter fiscal measures, good investment incentives and training and greater diversification of production and marketing to help increase the volume of tertiary products for both domestic and export demand without increasing wood

The role that TOF can play as a fall-back resource for the vulnerable in times of crises currently forms part of the current concerns of the Ministry of Lands and Forestry (MLF). It is quite difficult that such value cannot be quantified in terms of global contribution of forest exploitation to GDP, it must be seen in respect of the economic value, including their contribution to the significant trading of the economic value, including their contribution to the significant trading networks based on NTFP exploitation, and to local income; and also the social value, which can be seen in terms of the role they play in sustaining livelihoods in the rural poor. Linked to this is the issue of benefit flow in respect of sustainable TOF exploitation.

The Ministry of Lands and Forestry intends to pursue an essential strategy of conducting regular reviews of forest (and wildlife) fees to reflect the economic value of the resource and to recover optimum revenues for supporting the costs of sustainable management. Under the 1994 Forest and Wildlife Policy, government has also given its commitment to the principle that "a share of financial benefits from resource utilization should be retained to fund the maintenance of resource production capacity and for the benefit of local communities". An important aspect of an improved fee structure is the administrative capability to collect such fees timely and to account for them totally.

Constraints

The main constraints to the sustainable development and management of TOF include obsolete laws and regulations, limited financial resources and inadequacy of line agencies and their working conditions. Also, the trade associations and respective public agencies have not yet developed the mutual appreciation and understanding that is necessary for fostering an enabling environment. In addition, there has been a significant lack of initiative on the part of the private sector to respond positively to policies and incentives with respect to exploitation of TOF.

Another constraint is the issue of an appropriate institutional structure and arrangement to facilitate sustainable forest management. The performance of government forestry sector institutions have in the past been severely hampered by its civil service structure, which resulted in ineffective administration and poor monitoring of forest operations.

The Forestry Commission Act, 1999 (Act 571) was therefore formulated to put in place an efficient and cost effective institutional framework for the successful implementation of forestry policies and programmes. Act 571 replaced the old Forestry Commission, within the Civil Service, with a new Corporate Forestry Commission to minimise bureaucracy, allow for the timely recruitment of competent staff with adequate remuneration and ensure better funding of programmes to ensure sustainable management of the forest resources. Under the Forestry Commission Act,

1999 (Act 571), all the forestry sector institutions were made divisions of the FC, which was given implementation autonomy under the law. Critical to successful reform is the need for adequate financing and capacity building for the FC to be effective.

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Trees Outside Forests : What Incentives and what Outlook studies?

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Are Trees Outside Forests the future of the forests? Hopefully not, but in many places the room of TOF is likely to raise as natural forests area will decline. TOF use, planting and management have become a critical issue in rural development and it is also considered as an option for wood industry and energy policy makers.

The Trees Outside Forests and the law

TOF management has been hampered by land-tenure legislation, in many of which right on the land was the one that took over rights on other resources linked to the land itself.

It has been also hampered forestry codes, in which any tree outside fields and garden areas in the landscape was potentially subject to specific regulations.

Historically, rural societies were used to have different use or property rights on various resources, and one individual would had enjoyed yields rights, another one grazing rights and a third gathering rights on trees on the same area. With the recognition of so-called "modern ownership", the variety of property rights has been turned down into a single and "absolute" right given to a single juridical entity (individual, company, local council, the State...).

In actual rural societies, trees outside forests have an ambiguous position. On one hand, they are land ownership markers, a testimony of a long an peaceful occupancy; on the other hand, any endeavour to plant some trees

could be felt as a threat by "traditional owners" lending temporary the land to migrant under customary rules. Trees are, thus, vectors of land tenure conflicts as it is the case in several West-African countries (Benin, Côte d'Ivoire...).

TOF are also means of "boserupian intensification path": used as fences to keep animals away from permanent crops, they are both limits markers (Madagascar, Comoros, Western Cameroon...) and tools for intensification process. In several ways, TOF have to do with land property but often not in a straight way.

Is land titling the solution?

In many parts of the world, uncertainty about ultimate land rights hampered tree plantations and management. Is there only one way to address such a problem?

Secure land rights through land titling or through use right registrations is sometime possible and relevant. But in many conflicting situations, that type of solution is unworkable as the conflict is not matter of area boundaries, but of the legitimacy of land occupancy itself. The problem, in this way, is the same with land rights registration, a potentially useful tool, used in Western Africa, but implemented too closely as a mere substitute for formal land titling

Is there a room for innovative solutions, mixing negotiation processes, rural contracts and division

of property rights on land and associated resources in order to give a relative security to both original land owner and actual occupant? Then very recent Congo Law includes provisions allowing such a scheme. A challenge for the future would be to explore the scope for new legal arrangements entitling stakeholders with use rights on different resources which uses are embedded within the same areas. This is the only way if one want to avoid a very likely consequence of land titling generalisation: the exclusion of poorest people from rights and benefits they can have only through access maintaining, not from land titling.

Influence of forestry codes

But planted wood are not the only TOF. When agriculture expand in forest areas, some farmers leave trees on the field, but other do not. On one hand there is the possibility to sold a valuable tree to a logger, on the other hand there is the risk to be subject to forestry code with, potentially, eviction of the newly created field, or distribution of logging rights to operators without financial compensation. How to change incentives structure in such a case? There is no mere and straightforward answer, but in each situation some arrangements are possible. In areas bordering the forests, granting (or recognition) of trees property might encourage conservation of the most valuable trees. Obviously, it might give legitimacy to slash and burn agriculture in areas where governments want to promote strict conservation or industrial use of the resource.

The starting point is demand and market access

If security of use and transmission are critical incentives, economics is the

other part of the story. TOF can be valued through products (fruits, rubber, oil, fodder, etc.) all along their lives and as wood (solid wood, pulp, firewood, energy wood) when matures or older. Multiple use trees are obviously preferred by farmers. Promoting use of tree products other than wood and allowing farmers to keep a significant rent share, provide economic incentives for plantation of such trees and their proper management. There is a significant scope of progress in the matter, where the Governments, NGOs, traders, rural projects, can play a role. But many of these products have substitutes and are subject to inherent volatility of commodities markets and, in many cases, the domination of intermediaries leads to disappointing revenues for farmers.

The wood ought to be more considered, even if the main motivation for planting trees in fields and fallow will remain "flux" products, for households needs satisfaction. Trees are incidentally planted for the wood, and sometimes for solidwood. Time matters also for farmers, and economic incentives would have to address short term revenues alongside middle and long term financial promises.

Subsidising farm tree planting seems not to be the best solution. Public subsidies, through specific projects for instance, is by nature unlikely to be sustainable. The real incentive will be given by market prices, that should be high enough to pay all the "opportunity costs" associated with tree planting, a time and land consuming activity. Government and projects focus should be on market access obstacles removal, rather than subsidising tree planting. Such a challenging goal, include many aspects: disseminating information, promote rural market places where farmers and several carriers can meet...

Another major obstacle to reach market places is the road control abuse by forest administration and authority forces, when money is extorted to carriers under the pretence of illegal logging activities control. Some promising tools have been experienced in Sahelian countries, as in Niger, where fuelwood rural market, co-managed with forest administration, are allowed to deliver legal-like document attesting the legality of wood origin. Such a formula can be implemented also with out-growing schemes, where local and private producers are supplying a specific industry and where contract documents can be shown at any stage.

If one considering that wood processing industry in Côte d'Ivoire has been actually saved from log shortage by Trees Outside Forests collected in fallow lands, fields margins and degraded areas, one should concludes that there is a scope for "win-win" arrangements for both farmers and loggers. But there are pre-requisites: recognising farmers rights on tree selling, thus clarifying, and secure, rights on lands. Economics cannot escape from land tenure and institutional arrangements.

Several industrialist, in Côte d'Ivoire and elsewhere, are looking for (and already practising) out-grower schemes with farmers and communities. That is certainly a promising way, providing communities and individuals are supported to negotiate fair contracts and the Governments commit themselves firmly to handle in a realistic way land tenure issues and local rights on resources as TOF. The Administration must be aware also that large-scale plantations funded with public subsidies might result, in some cases, in lowering the average price for wood, thus provide disincentives for individual/collective proper

management and further planting within farming systems.

Taxation issues

Taxation regimes are likely to impact the incentives structure too. If trees have been planted and managed, stumpage fees or felling taxes seems to have negative effects on the incentive structure.

But if scattered, natural growth trees are concerned (as in many places in Côte d'Ivoire and Ghana), the resource used by loggers have to be paid to reflect its potential value and opportunity cost. If land royalties are in force, tax exemption for tree gardens and parks might encourage tree planting and management, providing the Administration have real capacities to monitor effectively the taxation situation.

Increasing loggers' access cost to the wooden resource is generally a sound policy, even if it is a highly sensitive issue with loggers and wood processors. Having significant levels of taxes not only provide money for public expenses and investments, but push the wood processing activity toward more efficiency, allowing it – on the medium/long term and providing it survives... – to pay higher prices for raw material. Sylviculture constraints stemmed from management plan enforcement combined with higher stumpage/area royalties tend to reduce large and easy wood availability, raise wood prices and put more interest in TOF development. However, in fiscal matter, things are not straightforward and forest taxation reforms ought to be wise, step-by-step and negotiated enough to avoid adverse effects and reach initial objectives.

TOF and “Climate Instruments”

Would the emerging instruments linked to environmental conventions, especially the UNFCCC – climate convention, be of some help for TOF development?

The Clean Development Mechanism could provide, theoretically, incentives, through small-scale and community targeted projects, to plant trees and to develop agroforestry. But, at this stage, it seemed that the mechanism is designed for investments in large scale projects, as industrial plantations, and not for investing and supporting clusters of small-scale initiatives, with high transaction and monitoring costs. The US defection of the Kyoto protocol implementation process, the amount of “hot air” available on the market will lead to a low price of carbon credits, leading to the “low-hanging” fruits scenario in which only very cost-effective projects are undertaken. CDM, at this stage, seems not being a

promising tool for TOF, unless if used in association with other existing tools (GEF, ODA, fiscal tools...) and if appropriate institutions are build-up (special investments funds targeting small-scale projects).

In that case, if trees are planted and managed in connection with climate change mitigation purposes, it would be necessary also to think about market outlets, otherwise the activity will be economically unlikely. There is, yet, a potential demand in line with UNFCCC ultimate goals: the use of biomass in modern ovens to produce (non-fossil) power supply in a decentralized way, for rural areas themselves. There is a case for such an energetic switch in developing countries and this would create a sustained demand for wood production and farming by-products. In that case, CDM can represent a powerful instrument, providing investments can reach both the electricity producer and the potential biomass producer.

Conclusion

In conclusion, one should say that views on TOF are evolving, slowly but surely. Forest are gradually eroded in developing, despite country' and international community commitments. But even if forest area are diminishing, trees might remain and (other ones) be replanted. This one aspect of the Kuznet's Curve (or Boseruperian scheme). Wood supply is not at risk, but biodiversity losses are serious within that process. Beyond incentives for TOF management and planting, one should also think about incentives to keep, to manage and also to re-create a diversified nature and landscapes.

In that respect, some Outlook studies would be of particular interest:

- In legal field, considered in a broad sense, several critical issues are to be addressed :
 - The prospect of formalizing a “right of the practices”, aiming at providing more security to resources users, especially those who use farm trees and would be likely to manage and replant them under appropriate local and legal arrangements. Potential of innovating tools such as “Rural Land Tenure Plans” (*Plans Fonciers Ruraux*, in French-speaking areas) are to be revisited and prospected in that way. New articulations between forestry codes and land tenure legislation are to be planned.

- The prospect for private rural loans to farm planters who do not have land titles. Arrangement like collateral guarantees given by local stakeholders might work or not: under what conditions?
- On the economic side, one critical point seems to be the market access for TOF products:
 - An assessment of the various nature of obstacles/barriers to market access for TOF products would help to prepare response measures, such as wood rural markets, cooperative networks for products transportation, better maintenance of rural trails, etc.
 - The indirect effects of forest policies on TOF products prices and market access are to be better known. What is the price effect on wood of public/subsidized plantations in various structure of markets? What is the effect of hardening resource access for loggers in natural forests, both stemmed from silviculture constraints and different taxation policies?
 - Out grower schemes, in one hand, tree by tree negotiation in the other hand, are 2 raising modes of interaction between farmers and private/industrial sector. Assessing the existing arrangements and foresee what improvements in terms of institutional mechanisms are possible (insurance system provided to contracting farmers by the private sector to minimize risks on the long range, for instance) would be one way to pay attention to local empowerment, fairness/equity issues and enhancement of the incentives structure.
 - Forest policies and international community-funded projects too often overlooked the small-scale/informal sector issue, even though this last have impressively grown in several countries where formal industries are focused on exportations not domestic consumption. Formalization and efficiency enhancement of such activities is likely to have in many places a significant influence on TOF through ability to pay higher prices, better market access through the legalization of a hidden activity, etc. Design policies in that matter is very challenging but very necessary.
 - Economic instruments related to global environment have not been designed for supporting small-scale activities. However, all the rules governing their implementation are not set yet, and there is a room for proposals. Innovative tools such as Clean Development Mechanism might be used, in combination with other instruments, to provide direct incentives for TOF plantations (out-grower scheme would be n indirect incentive). Outlook studies for designing the appropriate combination and use of mixes of economic & institutional instruments, existing or under construction, for TOF development appears worthwhile.

26/11/2001

Expert Consultation on Trees Outside Forests

“Enhancing the Contribution of Trees Outside Forests to Sustainable Livelihoods”

(FAO HQ, Rome Italy, 26-28 November 2001)

TOF Resource Study and Management: Assessment Methodologies and Institutional Approaches in India

By

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Abstract

Traditionally, forest inventories in various parts of the world have largely concentrated on assessing growing stock within notified forest areas. With rapid deforestation and loss of cover, there is an increasing interest to understand the role of Trees outside Forests (TOF) in providing ecological goods and services. TOF are playing a major role in carbon sequestration, fuel wood supply, erosion control, climatic stabilization and rural livelihood support. What needs to be ascertained accurately is the quantum of the TOF resource, its distribution and contribution. For this, large area TOF assessments need to be undertaken. The scattered and fragmented nature of the resource makes this task daunting and different from conventional forest inventories

This paper presents an overview of some of the important approaches used in India for TOF assessment. Assessment approaches have been categorized as ground based enumeration approaches or remote sensing aided approaches and discussed in context of their methodological details, merits and demerits. The potential use of remote sensing data has been highlighted as it can add accuracy and speed to certain TOF assessment tasks. A brief discussion on TOF management in India has also been presented focussing on legal issues impacting TOF conservation.

The overview suggests that there is inadequate data on TOF resources in the country and there is a need to evolve standard methods and institutional partnerships to collect data. The need to adopt enabling legislation in order to encourage private landowners and local communities to plant and conserve more trees has been highlighted.

Keywords: Trees Outside Forests, Remote Sensing, Assessment Methods, Sampling, Classification.

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Introduction

In the last two decades, countries like India have experienced massive deforestation. Official estimates in India put total tree cover on forestlands at around 63.73 million ha which is 19.39% of the total geographical area of the country. Out of this 19.39% forest cover, dense forest cover is only around 37.74 million ha or 11.48% (FSI, 1999). Independent sources (non-governmental) on the other hand are more conservative about these estimates. The destruction of forests have led to numerous environmental problems, most notable among them include disturbances in the atmospheric carbon balance, change in water regimes and accelerated soil erosion.

While national and global forest inventories have largely concentrated on monitoring the status of forests on notified forestlands, they have almost completely ignored estimations of Trees Outside Forests (TOF). TOF refer to trees on land not defined as forest or other wooded land and generally include trees on farmlands, in cities and human settlements, orchards, sides of roads, pastures, banks of rivers, streams and canals and as shelterbelts which are less than 20m wide and 0.5 ha area (FAO,1998). It is now being increasingly argued that the role of TOF in providing food and woodfuel to rural masses, carbon sequestration, prevention of soil erosion, biodiversity conservation, checking desertification, establishment of wildlife corridors and microclimatic stabilization, is quite substantial meriting a detailed inventory (Kleinn, 2000; Bhattarai 2000;Rowntree and Nowak 1991;Nowak 1994;Carucci, R, 2000). Ravindran and Thomas (2000) have shown how TOF resources provide livelihood support to local communities.

Notwithstanding the fact that pressure due to the demand for woodfuel has been one of the main factors that has contributed to deforestation, trees outside forests are also playing a significant role in meeting rural domestic fuelwood requirements. With the destruction of forest lands there is a marked shift in the supply of woodfuel for domestic consumption from forest to non forest lands. On an average, almost 50% of the domestic woodfuel in Asian countries comes from non-forest lands. These figures are significantly skewed in countries like Bangladesh, Pakistan, Philippines and Sri Lanka where non-forest land contribute close to 90% fuel wood (FAO, 1997). In India, this figure is around 50% (FSI 1996,FAO 1997). Share of wood energy from non-forest lands used for cooking in rural India is 59% while that of biomass energy is 90% (Saxena, 1997). Table 1 summarizes a comparative shift in supply share in rural household fuel wood in India from forestlands to non-forest lands in the period between 1978 to 1992 (CSE 1999).

Table1: Rural Household Fuel Wood Collection in India

Fuel Wood Source	Percentage Supply Share	
	1978	1992
Forest Land	35%	17%
Non-Forest Land	59%	78%
Other	6%	5%

Source: Centre for Science and Environment, New Delhi, CSE 1999.

In another study, Rai and Chakrabarty (2001) estimate that of the total fuelwood requirement in India in 1996 (201 Mt), 51% (103 Mt) came from forestlands while the remaining 49% (98 Mt) came from non-forest lands.

In view of the above, it is now being increasingly felt that large-scale assessments and inventory of TOF is crucial to fully understand the role being played by trees outside forests. Such information is also needed to evolve plans for sustainable management of TOF.

Methods for Assessing Trees Outside Forests

Globally, there are very few published studies on large-scale TOF assessments. Sylvander (1981), Holmgren et. al. (1994) provide a few notable examples of TOF surveys. Klienn (1999) provides a pilot study compilation of TOF information for six Latin American countries. In the South Asian region some studies on the estimation of wood resources have been undertaken in India, Pakistan and Sri Lanka (Pandey, 2000).

Approaches to assessment of TOF have been somewhat adhoc and can be broadly categorized into the following two familial groups:

- (a) Approaches involving Enumeration through Ground Based Surveys, and
- (b) Approaches aided by Remote Sensing

In the past, there has been a dominance of ground survey based approaches to TOF assessment. Although such enumeration provides accuracy, it has limitations in terms of area coverage, time, cost and repeatability. One other factor for increased preference for ground based sampling in the past has been the poor spatial resolution and high cost of data from remote sensing satellites. As a result, assessments attempting to use satellite data for studying TOF have been constrained in varying degrees in terms of accuracy, costs, complexity and technological feasibility. However due to the availability of higher resolution satellite data at increasingly affordable prices, the potential of remote sensing based approaches in aiding large area TOF assessments is generating wider interest.

Kleinn (2000) has highlighted some key knowledge concerns in collecting TOF data. Some of these issues include the need for an appropriate classification system for TOF data, ownership and geometry of TOF, appropriate sampling design, and high heterogeneity of TOF resources. These unique conceptual and methodological impositions make TOF assessments fundamentally different from classical forest inventory approaches. In this context, it is important to note that a number of studies which have been quoted in literature as TOF assessments have been undertaken with very specific and focussed study objectives. They are grossly deficient in the holistic TOF scope both in terms of their inclusion of the total TOF classification span and also in terms of addressing information needs to support the wide range of attributes listed to justify the need for conducting TOF assessments. Examples of focussing on one TOF component include studies concentrating solely on tree enumeration of farmlands or in urban areas or riparian habitats. Examples of focussed objectives include surveys on non-forestland to assess wood stock, woodfuel, and erosion control potential. With TOF emerging as an important area of research interest, it is desirable that TOF surveys cover the totality of the TOF concept in their assessment design.

Due to lack of standardization, suitability of an approach for TOF assessment for a specific situation invariably involves some kind of tradeoff analysis. A number of parameters can be involved in comparing different resource study approaches. Table 2 below highlights some of these parameters and the questions they aim to address.

Table 2: Parameters to compare different TOF methods

No	Parameter	Questions Being Addressed
1.	Area Covered	<i>How large an area can be covered using this approach? Does it permit large area coverage?</i>
2.	Time	<i>How much time does it take to complete?</i>
3.	Accuracy	<i>How accurate would the results be?</i>
4.	Representation	<i>How representative the results would be of the total Population?</i>
5.	Cost	<i>How expensive will it be to implement over large areas?</i>
6.	Repeatability	<i>How frequently can the method permit re-assessment?</i>
7.	Extrapolation	<i>How easy it is to use or replicate the method at other locations or for larger areas?</i>
8.	Complexity	<i>How complicated is the method to use?</i> <ul style="list-style-type: none"> ▪ Logistic complexity ▪ Technical complexity
9.	Feasibility	<i>How feasible is it to apply this method?</i> <ul style="list-style-type: none"> ▪ Is it technically feasible? ▪ Organizational feasibility

The following sections present a brief overview of some methods used for TOF assessment with particular reference to India.

Ground Survey Methods

There are very few published large area studies in India on systematic assessment of TOF. With the notable exception of studies done by Krishnankutty (1992) and the Forest Survey of India, most studies on assessment of trees on non-forest lands have mainly focussed on narrow geographical regions and very specific objectives. In terms of a review therefore, it is difficult to evaluate their applicability in the context of the currently emerging definition and scope of TOF. Nevertheless some of these studies do provide an insight into broad methodological issues involved in the assessment of TOF.

Chaturvedi (1990), focussed on the development of a methodology for fuelwood production from non-forest lands. The study concentrated on two villages spread over an area of 730 ha in the Gurgaon district of Haryana. Trees growing in these villages were classified as belonging to either homestead-planting stratum, commercial tree planting stratum or tree planting on farmland stratum. As the area to be covered was small, total enumeration was done for the first two strata while random sampling was resorted to for the third (the tree planting on farmland) stratum. Trees below 15 cms at breast height were not considered for this study. Regression equations for volume estimation of different species and local species volume tables were developed to

calculate expected yield of fuelwood for the two villages. The methodology developed as a result of this work is deficient for comprehensive TOF surveys on almost all parameters mentioned in table 2 with a possible exception of accuracy. Infact there are few methodological lessons from this study that can be used for a direct large area TOF survey encompassing all TOF classes and issues. It will be fair to mention however that this work did not aim to develop a large area TOF methodology and concentrated specifically on assessing village fuel wood supply.

A study conducted by Krishnankutty (1992) is by far, the first large area TOF assessment done in India. The study estimated volumes of growing stock of trees on the homesteads for the entire state of Kerala. Although the survey excluded from its scope trees grown on non-agricultural areas such as plantations (rubber, tea , coffee),roadsides and public building compounds, it was very comprehensive in covering trees grown on agricultural land of the state for various purposes. Krishnankutty used a three stage stratified sampling procedure to select areas for enumeration of trees. The percentage of dry land area under agricultural use to the total area (dry land area + wet land area) under agricultural and human population density were calculated for all revenue villages in Kerala. Five class groups were created for percentage of dry land to total area under agricultural use while three class groups were created for population density constituting 15 strata in all. Stages of sampling involved - (a) random distribution of 30 villages (2.5 % of total revenue villages) in the above strata ensuring that at least one village was included from each stratum, (b) selecting one census village (several make a revenue village) from each chosen revenue village and (c) considering all households in the selected census village for collection of information. This study estimated that during the period of the survey (88-89), the state of Kerala had 347.23 million trees growing on homesteads. The volume of growing stock of trees above 10 cm dbh was estimated to be 112.685 mcum. The study concluded that homesteads account for 80 percent of the wood supply in Kerala with 15 percent coming from estates and imports and only 5 percent coming from forests. The total contribution of non-forest area (minus imports) was 92.6 %.

The Forest Survey of India (FSI) is the national forest mapping agency in India. With reference to TOF, FSI started an inventory programme in 1991 with an objective to assess the extent of plantation raised under different forest schemes and estimate growing stock & species wise tree numbers of trees outside forests (Kumar, 2001; Pandey, 2000). As detailed by Kumar, the TOF classification adopted by the FSI is quite comprehensive and includes a total of eight TOF categories (Table 3). The sampling design is based on stratified random sampling with agro-climatic zones of the country providing the first stage strata, districts (or groups of districts) providing the second stage strata and villages in districts selected through proportional allocation providing for sampling units. Total enumeration of standing trees is conducted in the villages falling in the sample (the 1999 revision of this method does not stipulate total enumeration).

Using the above method, FSI has completed TOF assessments for Haryana, West Uttar Pradesh (UP) and West Bengal (Table 4). The study for the above areas reports a high positive correlation between village area, population and number of trees. Inventory work for the states of Andhra Pradesh, Gujarat and Rajasthan is nearing completion (Pandey 2000). In all the above FSI surveys, TOF resources within municipal limits of towns and cantonments were not included.

Table 3 : FSI TOF Categories

SNO	TOF Category	Explanatory Remark
1.	Farm Forestry	Trees along the farm bunds and in small patches up to 0.1 ha in area
2.	Village Woodlot	Naturally growing trees/planted on community/private land
3.	Block Plantation	Patches covering an area of more than 0.1 ha. and not falling in any of the above
4.	Roadside Plantation	
5.	Pond side Plantation	
6.	Railway side Plantation	
7.	Canal Side Plantation	
8.	Others	Trees not falling in any of the above categories.

Source: Kumar, 2001, Forest Survey of India, Dehradun, India

Table 4: Results of the FSI TOF Study

State	Number of Trees (000)	Volume (000)	Cover ^(a) (Sq. Km)
Haryana	54,984	10,328	1,375
West U.P.	1,33,982	30,306	3,350
West Bengal	1,96,000	----	4,900 ^(b)
^(a) Notional. Calculated on the basis of 400 trees per hectare.			
^(b) Includes trees having a girth of 5 cm and above.			

Source: Kumar, 2001, Forest Survey of India, Dehradun, India

Although FSI revised its initial methodology in 1999 with a view to optimize time considerations by not stressing on total tree enumeration of sample villages, it would still take considerable time to cover the entire country. In such a scenario, it is likely that by the time a national picture emerges, part of the data may become dated and possibly unrepresentative of the prevalent ground situation. Management plans using such data may have to offset possible discrepancies due to timeliness of data. Revision of the

existing method to include remote sensing based techniques might provide a viable mechanism to counter time lag problems.

Some other studies, particularly Ravindranath and Someshekar(1995) and Malhotra and Kumar (1987) use alternative sampling schemes for TOF assessment in rural and urban settings respectively. These studies have been briefly reviewed by Prasad et.al (2001).

As these studies concentrate on very small areas, it may be difficult to extrapolate techniques used for large area surveys.

The Indian Institute of Forest Management (IIFM) has also been working to evolve institutional partnerships in assessment of TOF. IIFM organized a workshop involving thirty Non-Government Organizations in June 2000 to assess TOF in India. As a prelude to this workshop, secondary data was collected from a variety of sources such as district rural offices, land record offices, district statistical offices, village interviews, municipal corporation offices and other similar sources. Primary data was also collected through sample field surveys conducted in the state of MP in urban, semi-urban and rural settings. Using the above data sources, an attempt was made to assess the total number of trees outside forests in India. This exercise resulted in estimating 24 billion trees outside forests in India (Prasad et. al. 2000). Pending a detailed inventory for the country, this figure has been suggested as a rough TOF estimate for India.

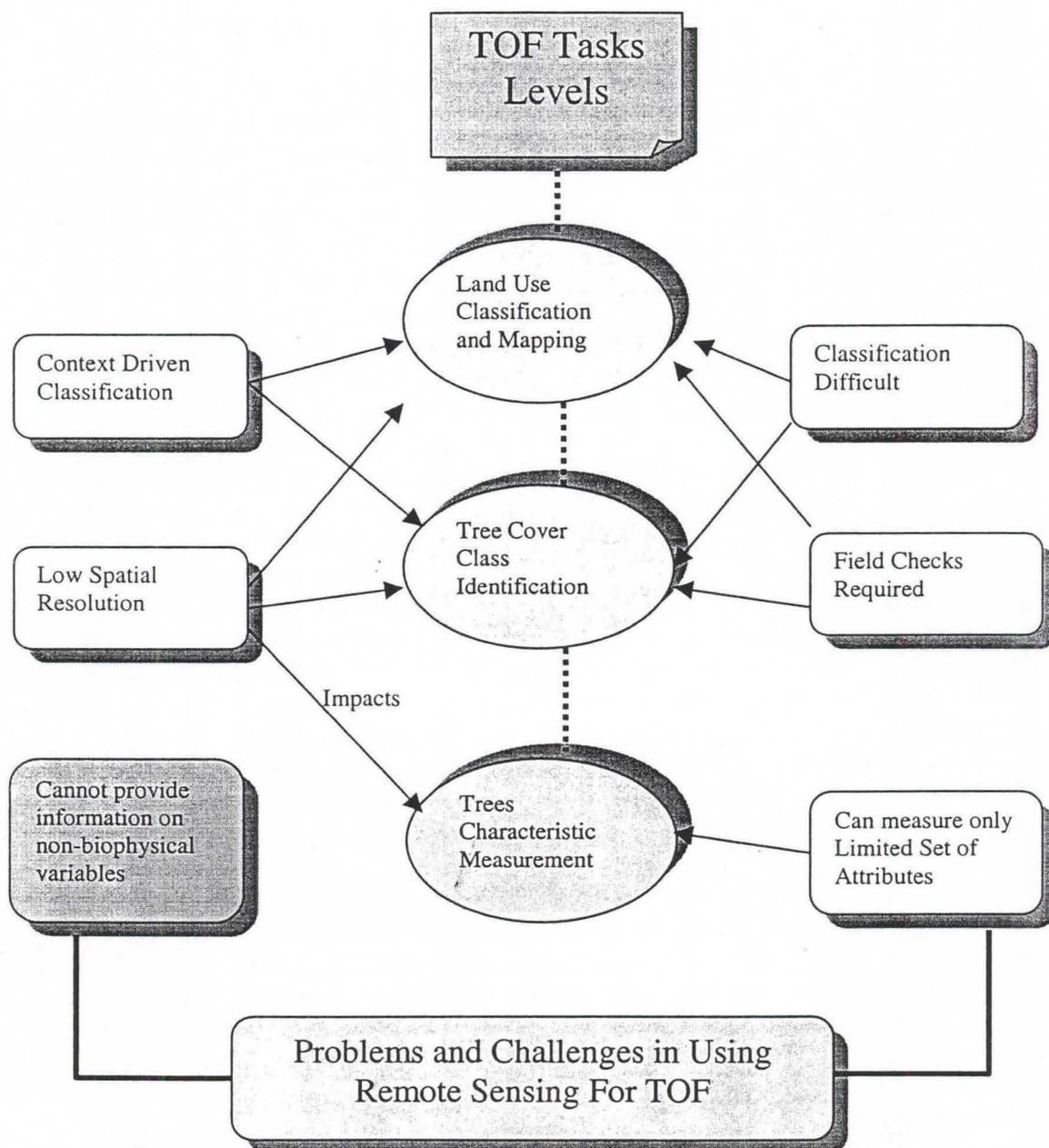
A study was also undertaken by IIFM to develop a methodology for assessing TOF in urban areas. This study resulted in the development of the Cardinal Grid Method (CGM) which was tested in the city of Gwalior, in Madhya Pradesh (MP). The CGM is a ground survey based method, which essentially divides the urban landscape into residential, institutional, roadside and other (garden/pond/park/temple) cover categories. Four quadrants are laid in each of the east, west, north, south and central zones of the city. Tree information in these quadrants for all the categories is collected by total enumeration. Different sampling distributions are employed for different landscape categories. Collected data includes number, species, girth and height of trees. Using this method, an estimation of the tree population in the city of Gwalior was made. The CGM is currently under development and the test experience at Gwalior has provided important inputs for the further refinement of this method.

IIFM with support from FAO also organized a National Workshop on the information analysis on TOF. One of the major focus of this workshop was to bring together a diversity of institutions to evolve partnership and standardize TOF assessment methodology. Most desirable methodological scenarios for TOF assessment were developed during this workshop, which have been summarized in Prasad et. al. 2001.

Remote Sensing Aided Approaches

A search of literature reveals that the use of remote sensing for TOF assessments has not been widespread. In a large part, low spatial resolution data from satellites, high cost of aerial photographs and the inability of the hitherto available remotely sensed data to provide TOF specific information have been some of the limiting factors in the use of remote sensing for TOF work. Kleinn (2000) argues that of the three levels of tasks involved in TOF assessments namely Land use classification and Mapping; tree cover class identification and measurement of tree characteristics, remote sensing is particularly suitable for the first two. Figure 1 summarizes some of the important limitations and

Figure 1



After Kleinn, 2000.

challenges suggested by Kleinn for using remote sensing for TOF assessments. The cost of high-resolution satellite data and equipment and expertise required for analysis can also be prohibitive in using remote sensing techniques for TOF surveys.

In spite of these inherent limitations, remote sensing has been used for TOF assessments. Wood sources in non-forest areas have been estimated in Sri Lanka during 1981-83 using aerial photographs and satellite data (Pandey, 2000). The study was successful in assessing non-forest areas having good crown cover but could not isolate sparsely vegetated patches or isolated tree clumps.

In the Indian context however, there have been no major attempts in the past to use remote sensing in TOF surveys. Recently Ashutosh (2001) has attempted to use IRS I-C LISS III & PAN data in the Bijnor district of Rajasthan for mapping TOF and analyzing the tree cover map in GIS for suggesting an inventory design.

The methodology essentially uses satellite data to identify TOF patches through digital classification. Principal Component Analysis was used to first segregate tree vegetation from agricultural vegetation. The remaining area (minus the agricultural vegetation) was then classified using a hybrid classification strategy involving isodata clustering and maximum likelihood classification to map TOF patches. Out of the total 338 Sq. km of forest area for Bijnor (which is 7.4 % of the geographical area of this district), this study estimated that TOF resources in the district occupy 2360.2 ha. The TOF distribution (coverage/occupancy) assessed in these areas included 1.91% area of 60m buffer along canal, 17.10% area of 40m buffer along road and 5.42% area of 1 Km radial buffer around villages.

The analyzed data (raster) was vectorized into a GIS layer to facilitate development of an inventory design. The minimum size of the TOF patch considered for mapping (and vectorization) was 0.2 ha. The TOF patch size was then used as a basis for generating three homogenous strata and assigning patches to different strata (Table 5).

Table 5: Stratum and polygons identified after considering TOF Patch Sizes

Strata Number	Strata Criteria	Number of Patches Qualifying for this Strata
Stratum I	Patches of size between 0.25 – 0.1 ha	12088
Stratum II	Patches of size between 0.1 – 1 ha	3321
Stratum III	Patches of size >1 ha	214

Source : Ashutosh, 2001.

Samples were then drawn from these strata and enumeration work using ground survey techniques was undertaken for the selected patches. The ground enumeration and data analysis work is currently under progress and is likely to be completed soon. As results of the enumeration come, it will be useful to see how successful and accurate the classification has been to identify TOF patches. As the Bijnor district of Rajasthan is a relatively dry area with sparse vegetation cover, classification success in locating TOF

patches may not be replicable in more vegetated areas where spectral confusion could be substantial.

Although not specifically directed towards TOF assessments, Rathore (1999) has demonstrated the potential of a model aircraft fitted with an ordinary camera for rapid low cost qualitative aerial surveys of tree resources distributed in a relatively small area. A model aircraft having a five feet wing span (figure 2), was fitted with a simple auto focus, auto film advance camera (Minolta AF-E) loaded with a Kodak 400 ISO colour film. The camera was placed in the belly of the aircraft looking vertically down at the nadir.

Photographs taken from this craft (figure 3) show that identification of species and count of trees can be easily done for sampling units spread in a local area. As photographs generated from this platform lack the geometric qualities of conventional aerial photographs, quantitative estimation of individual trees is not possible. The aircraft can also easily support small sized camcorders, which can provide instant results on completion of a survey sortie. The aircraft is very economical to operate with the cost of obtaining 36 colour photographs in about 10 minutes of flying time being around 7 US dollars (inclusive of fuel, film and processing in India). The craft can be launched by hand and its flight is controlled using a remote controlled device from the ground. The use of this technique can provide accurate tree counts, approximation of girth classes based on canopy cover and species identity serving as an invaluable TOF survey aid. It can also be used to support satellite data analysis by providing excellent ground truth information and aiding signature extraction.

With the availability of IRS PAN data having 5.8 meter resolution and IKONOS Panchromatic and Multispectral data having 1 and 4 meter resolutions respectively, many constraints faced in the use of remote sensing techniques for TOF could now possibly be resolved. Leatherman (2001) reports on a project underway to map trees in the Washington metropolitan region covering an area of 634 square miles. The project proposes to use IKONOS data to map every tree in the region. It is suggested that the information through the survey would provide thematic layer information in a GIS permitting tree information to be viewed with other planning parameters. The methodology developed as part of this project will be replicated at other sites.

In the near future, new and emerging remote sensing technologies may lend themselves for TOF assessments. For example, in the last few years, there has been considerable interest in the Lidar (Light Detection and Ranging) remote sensing. Lidar data has been found very useful for forest inventory and volume estimations. Means et. al.(2000) have used Lidar based techniques on 50m by 50m experimental plots in Oregon USA. These plots had all developmental stages of vegetation, which included shrub dominated, young, mature and old growth cover. They were able to accurately estimate stand characteristics such as height & volume using regression analysis based on lidar and ground data. Means et. al. have estimated that on a comparable basis, an inventory involving 14 weeks and \$32,000 could be done using lidar methods in 10 weeks costing \$15,000. They have indicated that the technology has good potential for non-forest cover estimations such as mapping vegetal cover along streams. The availability and costs of the use of this technology may however be prohibitive for large area TOF studies currently.

With particular reference to India, the cost of using high-resolution satellite data like IKONOS (or even IRS PAN) for large area TOF assessment is currently prohibitive.

Figure 2: Model Aircraft developed at IIFM for taking low cost pictures

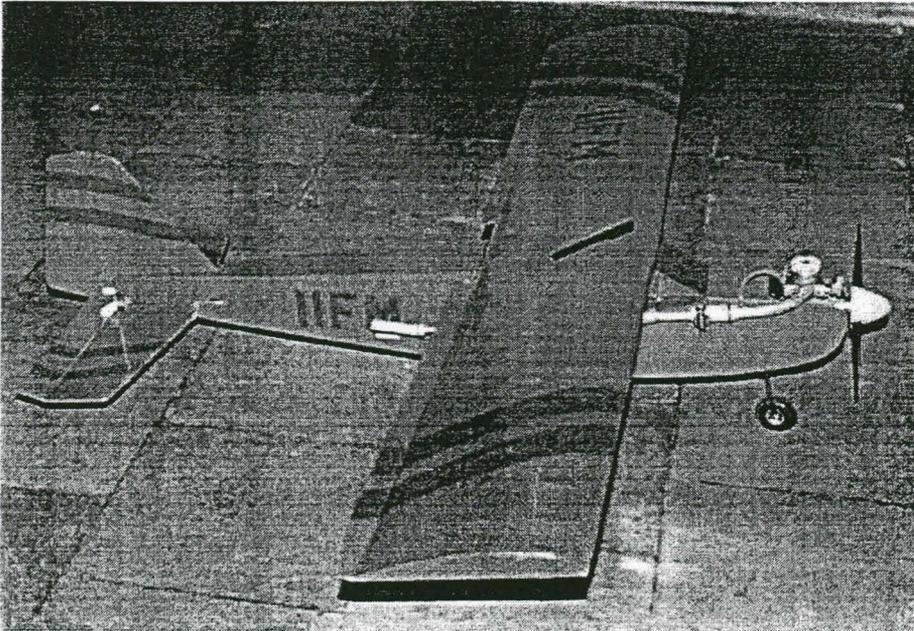


Figure 3: A Picture taken from the model craft showing individual trees

As field studies cannot be avoided altogether even with the use of remote sensing, ground based sampling is currently a cheaper and more accurate option. Although, the combination of IRS PAN and LISS-III data has potential for TOF assessments, more studies would be required to standardize and integrate remote sensing techniques with ground based information collection methods to cover the full range of TOF information issues. The use of GIS to view TOF information with other data will also prove useful in preparing management plans.

Emerging Perceptions on TOF Management in India

In a large part, TOF resources in India are distributed over community lands, revenue lands, common village land and private land. Traditionally, the provisions of the Indian Forest Act of 1927 have largely influenced TOF management in India. With reference to implications on TOF conservation and management, Chapter V of the Indian Forest Act (1927) details instruments for 'control over forest and lands not being property of the government' (Table 6). This act has provided the basic framework for enactment and adoption of forest acts and rules in different states in India. Through many legal and executive provisions under this legal ambit, tenural rights to own, fell, transport and dispose TOF resources are defined and enforced by state governments. Provisions of the Land Revenue Codes of different states also govern tenural rights of TOF resources on revenue lands. For a long period, these tenural laws and regulations have not provided much incentive for growing trees on private lands being regulatory in nature. Rather in some ways, they have created disincentive for tree cultivation on private land.

Table 6: Sections of Indian Forest Act 1927 for control over Non-Government forests and lands

Section	Provisions
Section 35	Protection of forest for special purposes.
Section 36	Power to assume management
Section 37	Expropriation of forest in Certain purposes
Section 38	Protection of forests at request of owners
Section 41	Power to make rules to regulate transit of forest produce.

Srivastava (2001) provides an excellent and detailed analysis of the legislation in India for non-forest lands. This detailed analysis of the legislation of various state governments reveals that most laws have been extremely regulatory in their legislative intent.

In the recent past however, there has been a perceptual shift drawn out of the above scenario where state forest departments are envisioning a change in their role of being regulators to enablers and facilitators. The Lok Vaniki Act (M.P. Act No. 10 of 2001), adopted recently by the Madhya Pradesh (MP) Government epitomizes this perceptual change that aims to substantially improve management of private forest lands and

encourage management of TOF resources on community lands through participatory effort.

The objective of the Lok Vaniki act "is to regulate and facilitate management of tree clad-private and revenue areas in the state of Madhya Pradesh and matters connected therewith or incidental thereto." In summary, the act empowers farmers to manage and extract benefits from their land by selling forest produce and timber. As an enabler, the role of the government is to dilute prohibitory laws, encourage participation of people and pull out once the system is set. As part of the Lok Vaniki scheme, it is required that private holdings be brought on record and a management plan be prepared by a chartered forester. The plan has duration of 15-20 years and stipulates prescriptions for scientific management of trees on private lands. Some salient features of such management plans include provision for felling only those trees that are above a certain girth, trimming of branches to open tree canopy and provision to fell up to four to five percent of trees annually (CSE, 2001). Another notable feature of the Lok Vaniki act is that the landowner is required to submit an annual 'Self Assessment Return' to the Divisional Forest Officer providing status of the implementation of the management plan & comparative assessment of actual and estimated. The act also prescribes that all land for which management plans have been prepared under the Lok Vaniki scheme will remain out of the purview of the land revenue code of MP with respect to permissions for felling of trees thus creating a single permission interface. Some specific provisions of the Lok Vaniki Act as highlighted by Srivastava (2001) are summarized in Table 7.

While the Lok Vaniki initiative can be considered a milestone act with reference to the TOF conservation, it needs to be seen how effectively deviations (stated in 'Self Assessment Returns') from management plans would be monitored and how corrective action for such deviations would be implemented on private land. The Indian Supreme Court's decision on its December 1996 interim order suspending felling of trees (including private land) would also be a determining factor in the long term success of the Lok Vaniki scheme. There is an opinion that the penal clauses in the Lok Vaniki act outlined in sections 8 and 9 are quite stiff and in some way retain the bureaucratic legacy of earlier acts. The major penal clause in section 8 mentions that "any person who acts in contravention of the provisions of this act or rules made thereunder or who after having approved management for tree-clad areas, fells trees or removes trees or any logs of the trees from the holding included in the approved management plan shall be liable to such penalty which may extend to twice the value of the trees involved but not exceeding One Lakh (0.1 Million) Rupees" (MP Government, 2001). There is no provision in the Lok Vaniki act for individual trees or isolated small tree clumps.

Another facet of the enabling process to facilitate better TOF management in India is through a move to include community forestlands in the ambit of Joint Forest Management (JFM). The Indian forestry sector in tune with the Indian National Forest Policy of 1988 has been an active proponent of JFM. Most states in India have adopted JFM resolutions and have implemented JFM on a large scale with a view to encourage village and community based institutions in managing forests.

There are however institutional and operational concerns that have been raised by a number of workers in context of JFM that may have some bearing on the success of similar initiatives for TOF management and conservation. Jeffrey and Sundar (1999) challenge some of the assumptions in community participation particularly focussing on the manner in which 'community' and 'participation' are being perceived by the forestry

sector in India. Supported by a number of cases by noted workers, Jeffrey and Sundar have expressed a view that the manner in which JFM is being operationalized is resulting in the creation of a new 'moral economy'.

Table 7: Summary of some highlights of the Lok Vaniki Act

Act Highlight	Details
An Enabling Law	<ul style="list-style-type: none"> ▪ Removes regulatory intent ▪ Reposes trust in people ▪ Provides a legal framework suited to the requirements of an independent, democratic and modern India. ▪ Encourages owners of private forests and other tree clad areas to manage their natural resource on scientific lines ▪ Encourages owners to assume responsibility of management themselves ▪ discourages clearing and conversion of area for non-forestry purposes ▪ Strengthens village institutions, empowers people
Provides Technical Forestry Knowledge to People	<ul style="list-style-type: none"> ▪ Chartered Foresters bring in scientific management expertise
Provides for Self Assessment by the Owner of Private Forests	<ul style="list-style-type: none"> ▪ Individual Assess himself through an annual Self Assessment Return ▪ Assessment records status of implementation of management plan, estimated & actual yields. ▪ Encourages owners to invest in management of their forest exclusively as a private enterprise without any burden of sharing with the Government, anything from their profit.
Provides a Single Window	<ul style="list-style-type: none"> ▪ areas covered by management plan under Lok Vaniki to remain outside the purview of the MP Land Revenue Code 1959 ▪ No need to go to multiple agencies for permission to fell trees.
Impetus towards Collective Mobilization and Organization Building	<ul style="list-style-type: none"> ▪ Promotes organization and coming together of owners to form associations to influence policy makers and cope with market fluctuations.

Summarized from Srivastava, 2001.

Such a situation according to them stands to further curtail customary and legal rights of the least privileged sections in the village society to natural resources. Long and Nair (1999) have examined some sociopolitico-institutional constraints to TOF development as widely adopted systems. The absence of a national policy on common lands has also been attributed by some as a possible reason for management problems for TOF resources.

Conclusion

This paper has attempted to present an overview of the resource assessment and management scenario for TOF resources with a focus on India. Like many other countries of the world, there is insufficient data on TOF resources in India. Looking at the role that TOF is playing as provider of environmental goods and services, there is an urgent need to develop institutional partnerships for carrying out large-scale TOF assessments. It is our view that TOF assessments on a national level require a strong collaborative framework of institutions and organizations working together for collecting TOF data. Such a framework is currently lacking in the country. It is strongly felt that if work of this magnitude has to be completed and systematized on a timely periodic basis, a partnership programme involving FSI, state forest departments, research organizations, academic institutions, NGO's and other related agencies would have to be created.

There is also an urgent need to standardize TOF resource assessment methods. The integration of remote sensing techniques with ground surveys will provide wide area coverage in shorter time spans saving costs. It is however felt that it may not be possible to altogether eliminate ground based data collection looking at information requirements of TOF assessments. Higher resolution data in the near future coupled with new remote sensing technologies like lidar will add accuracy to assessments and reduce survey time spans.

TOF management so far in India has been governed by largely regulatory forest legislation. With acts like the MP Vaniki act, a noteworthy effort has been initiated by the MP state government to express its intentions as an enabler and facilitator in TOF management. Strengthening of such legislation and adoption of similar schemes by other states in the country could have a marked impact on TOF conservation.

In conclusion, it will be worthwhile to stress that TOF assessments should be designed to include information collection over the full range of TOF issues that are used to justify the importance of TOF as a resource. Such a focus will help in creating a comprehensive TOF information structure that can be used to provide inputs for policy making.

Acknowledgements

The authors would like to thank Dr. D.S. Ravindran and Dr. R.K. Singh, Associate Professors at the Indian Institute of Forest Management Bhopal, and Mr. Pankaj Srivastava of the MP Forest Department for helpful discussions and comments.

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Expert Consultation on Trees Outside Forests

“Enhancing the Contribution of Trees Outside Forests to Sustainable Livelihoods”

(FAO HQ, Rome Italy, 26-28 November 2001)

Trees Outside Forests: The Woodfuel Production Context

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Context

The Regional Study on Wood Energy Today and Tomorrow in Asia (RWEDP, 1997c) categorically states in its Foreword that “developing countries in Asia are home to approximately three quarters of the world’s woodfuel users, but have only one quarter of the forest cover in the South.” With their ever-increasing populations and the associated growth in woodfuel demand in absolute terms, one wonders how the growing woodfuel demands in the household, traditional industry and commercial sectors of RWEDP member countries have been met over the years.

Indeed, if one refers to the FAO study of the early 1980s (FAO, 1983) that was conducted exclusively to draw attention to the problem of fuelwood (often referred to as ‘the other energy crisis in the Third World’) prior to the United Nations Conference on New and Renewable Sources of Energy, Nairobi, August 1981, it becomes difficult to imagine how the people in RWEDP member countries have managed to meet their needs for fuelwood over the past 20 years. Similar may be the situation in other Asia countries, as well as in Africa. The conclusion then was that without a radical change in the present (i.e. in 1980) fuelwood demand-supply situation, over 2 thousand million people, or double the number in 1980, would be affected by fuel scarcity by the year 2000. FAO’s assessment of fuelwood scarcity was based on both high population growth rates and associated fuelwood demands *vis-à-vis* accelerated rates of deforestation (shrinking supply sources) and limited possibilities for fuelwood replacement by other energy sources in the developing countries. The most important achievement of the FAO study was the attainment of its intended goal of raising awareness of both concerned governments and international communities about the energy problem of the Third World at that time.

The FAO study showed all member countries of RWEDP in South Asia and the heavily populated forest deficit zones of the countries in Southeast Asia facing fuelwood scarcities of different magnitudes. It was reported that people in the scarcity zones of South Asia were meeting their fuelwood needs by over-cutting the existing resources (or harvesting beyond their sustainable supply potentials), contributing to further deforestation and/or forest degradation. All types of fuelwood resources that existed at the time in developing countries were included in this assessment. This included natural woody vegetation (i.e. formations with over 10 percent of the ground covered by woody species), plantations (i.e. forest stands established through

afforestation and reforestation), and other types of natural woody resources (e.g. linear tree plantations alongside roads, railways and canals; scattered trees on farms, homesteads and hedges; woodlots, orchards and block plantations). Even the fuelwood production potentials of industrial plantations, from thinning and logging residues, as well as from the residues and byproducts of agricultural and industrial activities were taken into account for assessing the demand-supply situation.

Despite the bleak fuelwood demand-supply projections of FAO, more people today depend on traditional fuels than back in 1980s. And their demands of traditional fuels are being met one way or other over the past two decades. But most national statistics provide misleading information about the trends in energy consumption. They clearly show a decreasing share of traditional fuel in their annual energy balances. As their use was considered to phase-out over the years their development was never considered to be a priority. In reality, rather than decline, the use of traditional fuels in most developing countries has increased in absolute terms over the past two decades. In the 16 member countries of RWEDP the annual average growth rate in woodfuel consumption alone is about 1.6 percent (RWEDP, 1997c). How this incremental demand for woodfuel is being met remains an open question (or a mystery). This is particularly interesting with regard to those users in the zones previously classified as being in *Acute Scarcity Situations* and *Deficit Situations* in the FAO study of 1980. These zones include the sub-desert zones of Pakistan, the populated zones in the Himalayas, the Indian Sub-continent, Sri Lanka and Bangladesh, Central Thailand and Central Philippines, and the coastal plains and deltas of Vietnam. It appears that the people in these zones have managed to meet their energy needs without substantial official efforts to overcome the perceived problems in these zones, except for the promotion of activities like improved cook stove development, community woodlot establishment, and limited trials of other renewable sources of energy at national levels. One therefore wonders whether the authors of the 1980 FAO report missed some important supply sources, or if the productivity figure used for assessing the fuelwood supply potentials of different production systems were grossly underestimated.

Deforestation and woodfuel supply sources

Different studies conducted in the region underline that the universal cause of deforestation in tropical Asia has been the clearing of forests for agricultural expansion and other developments, not fuelwood collection. Nevertheless it has been observed that forest conversion also produces incremental fuelwood for local consumption, which would not have been available under the sustainable management regime of forests. In this way, a substantial amount of fuelwood is being produced currently and provides the cushion for absorbing the pressure of additional fuelwood demand particularly from industries and from urban centers. Such activities have taken place and are taking place with the approval of national governments and donor agencies. Unfortunately, the blame for accelerated deforestation is shifted to the poor who collect the fuelwood for free. It should be noted that the biomass fuels collected by the poor for self-consumption comprise mostly dead branches, twigs, leaves, and even pine needles and empty cones, or the products derived during the full-cycle of tree and shrub growth - products are not included in fuelwood supply-demand statistics. Most forestry statistics projects the sustainable fuelwood supply potentials in member countries do not take into account the biomass that can be harvested from

trees and shrubs under certain minimum diameter at breast height (DBH) or top diameter (i.e. 10-20 cm). Therefore the contribution of non-inventoried biomass which contributes to the domestic fuel supply to the poor remains still unknown. It will be also difficult to quantify these products in cubic meter or metric ton terms - the commonly used units for roundwood or fuelwood measurement.

One should be careful while using the national aggregate figures for making local, area specific, woodfuel supply-demand projections. Even in within the zone of supply surplus there could also be localized scarcities due to the uneven distribution of fuelwood resources, and limited or no access to the existing resources. No matter how rich a geographical area may be in terms of forest cover, it is only those resources which are located within a radius of 20 km that are accessible to the local woodfuel users/collectors for free (100 km for commercial traders), provided no physical or legal barriers exists to restrict the woodfuel flows.

Among RWEDP member countries that have faced acute fuelwood scarcities, China, India, Indonesia, Myanmar, Pakistan, Thailand and Vietnam have initiated large-scale fast-growing fuelwood plantation programmes. Nevertheless, one may have doubts about the ultimate use of the additional wood produced under these labor- and cost-intensive fuelwood plantations. Given the growing competition for wood in the local market, for industrial raw material and other uses, whatever incremental wood is produced from these plantations will most probably be delivered to the highest price bidders, industries and/or open markets, rather than as free woodfuel for the poor. Observation in some of these countries endorses that only small branches, twigs, stumps, roots, and leaves, or the residues and by-products of these plantations are supplied to the poor for fuel from these plantations.

In other member countries, tree planting and forest protection campaigns under the banner of social, community, private, and/or leasehold forestry development have been on-going for some years. These schemes have contributed substantially to expanding tree and forest covered areas, as well as woodfuel production. But to what extent? The data provided in Forestry Sector Master Plans of many South Asian countries show their total annual woodfuel demands far beyond the sustainable production potential of their existing supply sources, primarily natural forests and plantations. In most cases an increasing gap in the supply and demand in the future is projected.

The question arises: how have people succeeded in meeting their fuelwood needs over the years given the diminishing/shrinking resources? In most cases the unavailability of reliable data hinders attempts to answer such a question or even to make acceptable projections. In other cases, misinterpretation of available data, often to justify the sectoral biases of concerned agencies, has contributed to misleading (or even wrong) projections. There must be other unaccounted sources of either forestry and/or agricultural origin, which allow the people to meet their domestic fuel needs. In addition, people might also use inferior biomass to supplement their fuel shortages. Or else, the share of non-forest lands in fuelwood supply might have increased significantly. RWEDP's estimate already shows the average share of non-forest land in woodfuel supply as much as two-thirds of total consumption and the forest for only one-third in its 16 member countries (RWEDP, 1997c). The situation in Bangladesh,

Pakistan, Sri Lanka and the Indonesian island of Java show the crucial role of non-forest lands in meeting the woodfuel demand in these countries.

If this were not the case, then all existing fuelwood resources in severe scarcity areas would have completely disappeared over the past 2 decades, as predicted earlier. But this has not been the case anywhere. Still the traditional woodfuel users in rural areas have not switched-over to alternative commercial fuels (although some urban centers have started showing this trend for social, economic and technical reasons). Similarly, stove improvement programmes, promoted as an additional strategy to manage the fuelwood demand, have not achieved the expected success. Of course the progress under social or community forestry schemes has been tremendous in some countries, but no country has succeeded in establishing large-scale fast-growing tree plantations at low cost exclusively for woodfuel production to the poor.

Woodfuel from non-forest lands

Many countries in the Asia-Pacific region are reducing their reliance on natural forests for industrial wood as well as firewood and developing new supply sources (i.e. plantations, agroforestry systems, farm forests). The achievements of China, India, Indonesia and Vietnam with the establishment of large-scale tree plantations are well known. Many others have promoted participatory forest management programmes, including community woodlots, farm and private forestry development, and tree planting in non-forest land. Others, at least in specific locations, have been integrating multipurpose trees into different models of traditional land and tree based production systems. Therefore, recently the role of trees outside the forests in wood and fuelwood production has been gaining increasing importance. And further integration of trees into farming systems is expected to continue, which is expected to contribute significantly to industrial roundwood and fuelwood production in RWEDP member countries in the coming years. Swaminathan & Balaji (--) report that as much as 71 percent of the private land of 150 sample charcoal producing households previously used for raising Dry Millets, was used for raising *Proposis juliflora* plantation in the Tamil Nadu State of India.

In India, Saxena (in RWEDP, 1997a) citing Natarajan (1996) reports that only 17 percent of the firewood-collecting households depended on forests to meet their demand in 1992-93. Over 78 percent of the households collected woodfuel from non-forest lands (i.e. 48.5 percent from their own farms, and 29.8 percent from roadside bushes and trees) bushes and tree. The share of households who depended on forest for fuelwood collection in 1978-79 was about 35 percent. In the Philippines, about 58 percent of the households depended on gathered or self-collected fuelwood and another 28 percent on purchased fuelwood. Among self-collecting households 45 percent collected fuelwood from their own land or the private land of others (Rebugio *et al*, 1999). Aggregate national data explaining the share of forest and non-forest supplied woodfuels are not yet available, except for Pakistan (GOP/WB/UNDP, 1991), but a number of RWEDP-sponsored area-based studies and other studies (by UNDP/World Bank under various ESMAP projects in the region) suggest an increasing role for non-forest lands in meeting the fuelwood needs of the people in member countries (**Table 1**).

Conclusions

Numerous country and area-based case studies (sponsored by FAO-RWEDP, World Bank, UNDP, etc. in the 1990s) suggest that in most cases there is no “gap” in the supply-demand of traditional fuels. In many places people did not rely solely on natural forests and plantations to meet their domestic fuel needs. It was commonly found that people who lived in areas with limited access to, or devoid of existing forests and plantations, developed either alternative woodfuel supply sources on non-forest lands, or switch-over to other locally available inferior biomass for substituting their domestic fuel requirements. None of these studies categorically identify woodfuel collection by the poor as the main cause of deforestation. Of course, in specific locations of high population and low forest cover, unsustainable woodfuel collection did contribute to forest depletion locally. The findings of many area-based woodfuel flow studies suggest to simplify the legislation in forestry and related sectors, to encourage non-forest area based woodfuel production, flow and utilization in member countries.

Forest or non-forest source, which plays an important role in the supply-demand of woodfuel could be area-specific. The role may change significantly between sources from one place to another, depending upon the local supply-demand situations of woodfuels. It may change between places within an administrative district of a single country. One could observe in areas close to fuelwood resources (i.e. natural forests and plantations), local people – including the populations of small towns – tend to rely more on these public sources to meet their domestic fuel requirements. However, rural households at a considerable distance from the natural supply sources have either managed alternative fuelwood supply sources on non-forest lands or supplemented their fuel requirement with other inferior traditional fuels. Most people in larger urban centers, on the other hand, seem to opt for alternative commercial fuels wherever available and affordable. Some traded woodfuels used in many large urban centers, industries and commercial establishments could also be produced from non-forest lands. Therefore, which of the two supply sources are more important from the point of view of meeting the local energy needs is very much location-specific. Either or both could be of paramount importance in a given area depending upon local physical, social, economic and environmental conditions. The use of woodfuel, other biomass (crop and/or animal residues) or commercial fuels depends on the access to and/or availability of alternative sources to meet the energy needs of the traditional users, including their fuel choice and mix. But the extent of this dependency remains unclear.

Therefore, a proper assessment of micro-level, not macro-level, situation of woodfuel supply-demand would be necessary, not only to understand the prevailing system of production and flow but also to promote sustainable bioenergy utilization policy for the future. Generation of area-specific data would be necessary also for planning and implementation of decentralized rural energy program in rural areas. Increasing availability of modern bioenergy technology in commercial markets, for application in the household, industry and commercial sectors, recently, some farmers and private investors have been motivated to raise tree and energy crops on non-forest lands, even by replacing some important food crops in farms. Such new trends are slowly emerging in both developed as well as developing countries.

With the growing concerns for health, gender and global climate, future prospect of this carbon neutral, renewable source of energy is expected to gain in importance globally. This trend has already become more visible in many developed countries. It is expected to expand commercial tree planting and energy crop production in private farms and other non-forest lands, both productive as well as marginal lands. However, sustainable bioenergy development calls for reforms in legal and institutional fronts, as well as in extension methods and support services in the forestry, agriculture and energy sectors. Further, the land and tree tenure issues; production, transportation and trade in woodfuels; subsidies and cross subsidies on commercial fuels; technology transfer and dissemination; incentives and credit facilities; human resources, call for adequate consideration and concerted action, to promote sustainable woodfuel production, flow and utilization from non-forest lands in the future.

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Table 1: Fuelwood Production from Forest and Non-Forest Land

Country	Fuelwood Production (%)		
	Forest ¹	Non-Forest Land ²	Unknown
Bangladesh ³	13/ 75/ -	87/ 25/ 82	--
Bhutan ⁴	84	16	--
Cambodia ⁵	NA	NA	--
China ⁶	NA	26	--
India ⁷	51 / 17	49 / 83	--
Indonesia ⁸	6	65	29
Laos ⁹	>90	<10	--
Malaysia ¹⁰	NA	NA	NA
Maldives ¹¹	NA	NA	NA
Myanmar ¹²	60	40	--
Nepal ¹³	82.5/73	17.5/2	--
Pakistan ¹⁴	12.6	84.1	3.3
Philippines ¹⁵	13.7	86.3	--
Sri Lanka ¹⁶	11 / 12	75 / 69	14 / 20
Thailand ¹⁷	--	93	7
Vietnam ¹⁸	80	20	--

¹ Includes forest plantations

² Includes private farms, homesteads, community managed lands, shrub, scrub and waste lands, linear & scattered tree plantations, etc.

Data Sources:

³ GOB (in RWEDP 1997c) reports a 13% and 87% share of forest and non-forest; Ahmed (in RWEDP 1998a) shows a 75% share of forest in *Hathazari Thana* of forest reach Chittagong District; Hashem (in RWEDP 1998a) cites the Statistical Pocket Book of 1995 and presents a 82% share of homestead trees in 1991-92.

⁴ Sharma (in RWEDP 2000b) shows 70- 90% share of forest in local fuelwood supply in areas adjoining to the Black Mountain National Park in Bhutan, average share 84%.

⁵ RWEDP (1998) states that all firewood and charcoal traded in Phnom Penh market come from nearby natural forests, most locally consumed fuelwood in rural areas were collected from agricultural lands.

⁶ Yongqi Zheng (in RWEDP, 2000c) states a 26% share of non-forest land in local fuelwood supply in the Northwestern Provinces of China.

⁷ Forest Survey of India (FSI) shows the average share of forest and non-forest at the national level as 51% and 49% respectively (in *Fuelwood, Timber and Fodder from Forests of India*, 1996). Saxena (in RWEDP 1997a) cites Natarajan (1996) and presents 17% share of forests and 83% for non-forest areas (includes trees in farms and roadsides). Prasad (in RWEDP, 2000c) shows in the forest-rich North-Eastern West Bengal 80% of the locally consumed fuelwood came form forests, but in forest deficit Punjab its share was only 1%, in Rajasthan <5%, in Kerala 20%, in Southern West Bengal 11%. Alam et al (1984) shows only 6% share of government forests and 94% for private forests and farms.

⁸ Indonesia Urban Household Energy Strategy Study, World Bank/ESMAP, 1990.

⁹ Sawathvong (in RWEDP 1999) cites the information from Luang Prabang Province, Laos.

¹⁰ Poh (in RWEDP 2000c) identifies the wood residues generated in industries and energy plantation in waste lands as the two important non-forest fuelwood sources.

¹¹ the Country Paper of Maldives, 1995 states all fuelwood come from natural forests, no data given.

¹² Myint (in RWEDP 1997) shows a 40% share of non-forest land even in heavily populated Dry Zone of Myanmar. Hlaing (RWEDP 2000c) gives an average 24% share of non-forest lands in total fuelwood supply. Sein (in: *Non-Forest Area Based Woodfuel Production and Its Contribution in Rural Socio-Economy in Ayeyawady Division*, 1999, unpublished) states that the supply from non-forest area meets the present and projected fuelwood demand in all 5 Districts of Ayeyawady Division.

¹³ Shrestha (in RWEDP 2000a) shows 82.5% and 17.5% share of forest and non-forest supplied fuelwood; Water and Energy Commission Secretariat (WECS) Bulletin of 1997 shows the share of forest as 73%.

¹⁴ Pakistan Household Energy Strategy Study: Household Energy Demand Handbook, 1991, World Bank/UNDP/ESMAP. Siddiqui and Amjad (in RWEDP 1993) state the adjoining forests as the main fuelwood supply source to the city but private farms to the rural households.

¹⁵ World Bank/UNDP/ESMAP, 1991 The Philippines Household Energy Strategy; Espiritu (1999) states a mere 7% share of forests at the national level.

¹⁶ FSMP (1995) shows the share of forest and non-forest area as 11% and 75% respectively. Bhandartillake (in RWEDP 1998b) cites the National Consumer Survey report of 1990 and present the share of state forests, non-forests and other sources (includes farms and purchased) as 12%, 69% and 20%, respectively. Wickramasinghe (in RWEDP 1998b) show a 40% share of forest in 2 out 5 villages and no share at all in the other 3 villages studied.

¹⁷ Thai Forestry Sector Master Plan: Sub-sectoral Plan for Production and Utilization, Vol. 6, Royal Forest Department, 1993.

¹⁸ Tin (in RWEDP, 1996) states that 80% fuelwood is supplied from natural forests (47%) and forest plantations (33%), and scattered trees in farms meet another 20%.

Expert Consultation on Trees Outside Forests

“Enhancing the Contribution of Trees Outside Forests to Sustainable Livelihoods”

(FAO, Rome, 26-28 November 2001)

Urbanisation and Trees Outside Forest Issues

paper presented by

Dr Thomas B. Randrup¹, Dr Cecil C. Konijnendijk & Dr Kjell Nilsson

Introduction

The World Resource Institute (WRI) has estimated that by the year 2025 more than 85% of the population in Europe, North- and South America will be living in urban areas. In Africa, Asia and Central America the urban population will be 52%, 52% and 75% respectively (WRI 2001).

If the world is divided into categories of ‘urban’ / ‘rural’ and ‘developing’ / ‘developed’, then the main increase in population is estimated to be in urban developing, and urban developed areas (WRI 2001). Thus, there is little doubt that urban aspects of trees outside forests will be of major relevance in the years to come.

Existing focus on urban forestry, even in developing countries, has primarily focused on amenities and environmental benefits. In developing countries urban forestry should primarily fulfil basic necessities, which may best be achieved by multiple resource management (Kuchelmeister 2000). Urban forestry is in general a new approach. In the US, research has presumably not been formally carried out for more than 40 years, and in Europe the research experience is even shorter (Konijnendijk et al. 2000).

This paper will focus on urban forestry seen from an urban, developed perspective, and should be regarded as an input to future discussions of urban and peri-urban forestry in developing countries.

Urban forestry services to the urban population

Three types of urban forest services offer examples of how the higher degree of urbanisation has led to a new focus when prioritising tree goods and services: environmental or protection services, recreation, and enhancement of the quality of life.

The manifold environmental services trees provide have taken central stage, most recently because of the role trees can play in reducing atmospheric carbon dioxide levels and thus global warming. Decreasing labour hours, ageing of the Western population, changes in lifestyles, and a daily life more remote from nature have all led to a demand for a wide range of ways to spend leisure time. Moreover, the urban population has increased dramatically within the past hundred years and consequently the need for high quality and healthy urban environments to live and work has become more pressing.

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The need to cater for the new and multiple demands of an urbanising society calls for an appropriate response of forestry and other natural resource professions. Not only do different demands have to be met; this also has to be done with resources that are increasingly threatened by urban pressures such as air pollution, intensive use, construction and infrastructure development. Dealing with the specific demands and problems related to forests and other tree-based resources in and near urban areas calls for an innovative, specialised approach. Foresters traditionally are no experts in, for example, communication, public participation and conflict management, while working in urban environments requires a wider range of social skills (e.g. Kennedy et al. 1998).

As an answer to the new demands, the multidisciplinary approach of urban forestry has been developed, with its roots in North America (Miller 1997). Urban forestry can be defined as “the art, science and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic and aesthetic benefits trees provide” (Helms 1998). In Europe, this definition has been further elaborated into the, so-called, Urban Forestry Matrix (see Figure 1). The matrix is useful to explore what urban forestry actually entails. Thus, urban forestry does not only incorporate the planning and management of urban woodlands, but is an integrated approach towards all urban tree resources, incorporating also trees in park settings, including cemeteries, private yard trees and street trees.

Figure 1. The Urban Forestry Matrix

Approach	Type of sites		
	Street trees	Park trees	Urban woodlands
Form, design, functions and policies			
Selection and establishment			
Management			

The distinction between the three types of sites included in the urban forestry matrix arises from three different levels of stress, establishment techniques, average life time and cost in relation to establishment and management (Nilsson et al. 2001). For example, street trees are usually single trees, with a low average lifetime due to a relatively high stress level. Moreover, street trees in general generate high costs for management. Park trees too, are in general individual trees, with a medium or high average lifetime, medium stress level, and

medium costs for establishment and management. Trees in urban woodlands are usually established in stands consisting of small trees, with a high average lifetime, low establishment cost, and low management costs.

Identifying benefits and cost of urban forests

Urban forests are considered important because of their geographic extent, their impact on local economies, and their proximity to people. Because of their proximity to people, urban forests can provide substantial environmental, recreational as well as economic benefits to urban dwellers. Urban forestry is not a panacea for all the problems cities face, but it can make cities more liveable.

A European research survey indicated an increasing research effort within urban forestry being directed towards assessing and quantifying the multiple benefits urban forests provide to society (Forrest et al. 1999, Konijnendijk et al. 2000). Benefit-cost information seems much needed in policy making. Timber production functions of forests have been relatively easy to quantify in monetary terms. However, quantification of the benefits and costs of other goods and services is inherently more difficult, and the subject of much ongoing research (Mähler and Vincents forthcoming). This research focuses on the three issues mentioned in the previous section: environmental services, recreation and quality of life.

Firstly, *in relation to recreation*, a growing amount of surveys at local and national level has been carried out to assess the popularity of (urban) forests for recreation (e.g. Koch and Jensen 1988; Jensen and Koch 1997). Most popular and preferred are those forests and green areas closest to the home (Jensen 1999; Holm 2000; Hörnsten 2000). Traditionally, the recreational use of forests has been more or less free in most countries. Cost are, however, associated with maintaining recreational facilities although forests are inexpensive in management compared to, for example, parks and gardens (NUFU 1998). Ways are being explored to generate more income from recreation for forest managers. In some cases, local foresters charge small fees for visitor facilities such as guided tours, visitor centres and car parks. The Hoge Veluwe National Park in the Netherlands can only be entered after paying an entrance fee (Konijnendijk 1999). Despite traditional free rights of access, people often show themselves willing to pay small fees for recreational use. A study by Tyrväinen (1999) in two Finnish towns mentioned that about two thirds of the inhabitants were willing to pay a small fee for continued forest use.

Secondly, *in the context of environmental services*, more than 1 billion people worldwide live in urban areas with unhealthy air quality – although urban air quality has improved over the past two decades in most North American cities (McPherson 2000). Rising motor vehicle use, reflecting the increasingly sprawling form of many cities, poses the greatest threats to air quality. In the United Kingdom the government has estimated that more than 24 000 people die prematurely each year as a result of air pollution (NUFU 1998). Urban forests have a positive impact on air quality through deposition of pollutants to the vegetation canopy, sequestration of atmospheric CO₂ in woody biomass, and reduction of summertime air temperatures and associated ozone formation. Extensive studies in American cities have shown the significant filtering effects of trees. For the city of Modesto, the estimated air pollution reduction effect of the city's over 91 000 trees had an implied value of almost US\$1.5 million (McPherson et al. 1999).

Trees also have a secondary effect on air pollution, as their evapotranspiration cools the air and thus reduce the production and reactivity of pollutants. The shading and cooling effect of trees can have a dramatic effect on livelihood, and in the developed part of the world reducing cost of e.g. air conditioning, while the presence of trees can also reduce heating cost because of their insulating effect. Energy reductions for individual buildings in the United States ranged between 5 and 15% for heating and between 10 and 50% for cooling (McPherson and Rowntree 1993). McPherson et al.'s (1999) full assessment of all benefits and cost associated with a typical urban forest, indicate that benefits from energy savings, pollution reduction, stormwater runoff reduction, and aesthetic and other benefits in fact exceed management costs by a factor two.

Thirdly, *concerning the quality of life*, various studies have shown that the nearby presence of forests, parks and other green spaces have a positive effect on house prices, raising prices of at least several percent (e.g. NUFU 1998; Bolitzer and Netusil 2000). Tyrväinen (1999) used hedonic pricing methods to quantify the effect of nearby urban forest on house prices in two Finnish towns. Having a forest or other green area within 1 km of the dwelling had a positive price effect of 5.9%. In the town of Salo, people were willing to pay almost 5% extra if they could obtain a forest view from their house.

So-called green environments also attract businesses. An informal survey among businesses that settled in Telford New Town, United Kingdom after town establishment showed that a majority of the businesses mentioned "green environment" as a primary reason for opting for Telford (Simson, personal communication).

The effect of green areas on the health of urban dwellers is quite significant. Although trees might have some negative health effects – such as causing allergies – they generally enhance physical and mental health. A much-cited study by Ulrich (1984) showed that hospitalised patients recover faster from surgery when they have a window view of a green area. The establishment of health walks in e.g. the United Kingdom acknowledges the positive effect of regular exercise in pleasant green settings. Other health effects include protection against solar radiation.

In developing countries, the effects on house prices may not be the most relevant estimate to conduct. Effects of shade, woodfuel, water protection, storm water runoff etc. may have a much greater potential. However, these issues still needs to be dealt with in detail. Consequences of the trees in relation to each of these factors and the related values for the urban economy as well as the urban population need to be estimated.

The financial impact of urban forests' positive effect on mental and physical health has to our knowledge not been quantified yet. It could be significant in terms of avoided treatment and medication. The Danish Forest and Landscape Research Institute has initiated new studies in this field, and results are expected within the next two to three years.

Conclusion

To address the changing needs arising from a significant increase in the urban population, sustainable management of trees outside forests has to be enacted – either out of self-interest, market considerations or altruistic concerns for future generations. Urban forestry seems to be a good, effective tool for cities in developing countries to deliver benefits as discussed above. Integrated planning and management of all tree and forest

resources in cities is needed to be successful in a low-cost and sustainable way. Also, involvement of local communities seems very important.

In developing countries urban forestry, which to a large extent tries to address the changed values, is on the rise, but to a large extent is still based on values from the developed part of the world. However, increasingly urban forestry will find root in any country where cities and the urban population are growing. As such, urban forestry is a potential for growth. It has to be seen as a supplement to conventional forestry and as part of a sustainable development in the urban sector.

More information and existing urban forestry networks

Today, various networks of urban forestry experts exist, including the International Society of Arboriculture (ISA), the working group on urban forestry of the International Union of Forest Research Organizations (IUFRO), and COST Action E12 "Urban Forests and Trees". The latter, an EU-funded network of European urban forestry experts from 22 countries has placed urban forestry on the European research agenda (see www.fsl.dk/cost_e12/). As a spin-off of the network the European Urban Forestry Research and Information Centre (EUFORIC) was established as a thematic centre of the European Forest Institute (EFI) in January 2001. EUFORIC is hosted by *Skov & Landskab*, the Danish Centre for Forest, Landscape and Planning (see www.fsl.dk/euforic/).

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*consultation d'experts sur le renforcement de la contribution des arbres hors forêts
à l'amélioration durable des conditions de vie*

Rome (Italie) 26-28 novembre 2001

**LES ARBRES HORS FORETS EN AFRIQUE DU NORD
CONTEXTE ET TENDANCES**

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**LES ARBRES HORS FORETS AU MAGHREB
CONTEXTE ET TENDANCES**

INTRODUCTION

Les pays du Maghreb (Algérie, Lybie, Maroc, Tunisie) présentent un certain nombre de caractéristiques bio-écologiques et socio-économiques voisines, en particulier : ressource en eau limitées, vastes étendues arides, superficies importantes de parcours naturels, forte tradition d'élevage, pression démographique. Déduction faite du désert, ces pays présentent une proportion importante de superficies boisées, plus de 14 millions d'ha. soit 10 % de leur territoire, incluant quelques belles forêts naturelles en altitude et de bons boisements.

Les particularités de cette région réside dans son unité écologique marquée (ambiance bioclimatique méditerranéenne et ambiance désertique), la fragilité et la vulnérabilité de ses écosystèmes forestiers vis-à-vis de l'érosion, des incendies, des modes d'utilisation de l'espace ; présence d'une population nombreuse exerçant une pression considérable sur le milieu naturel pour la satisfaction de ses besoins de subsistance.

L'arbre joue dans cette régions un rôle écologique, social, économique et culturel majeure, et de temps immémorial, sous des formes diverses, il a constitué un élément fondamental pour la vie de ses habitants.

La classification des terres fait état de quatre catégories : les terres forestières, les terres boisées englobent les matorrals, les steppes d'alfa et les brousses d'acacia et d'épineux, les terres comprenant les arbres hors forêt (AHF) et les autres terres sans AHF.

Les arbres hors forêt, c'est-à-dire les arbres et les systèmes arborés que l'on rencontre notamment dans les terres agricoles, dans les près et les pâturages, sur les sols improductifs et dans les villes et autres établissements humains, jouent des rôles économiques, environnementaux et socio-culturels à travers leurs fonctions et les usages de leurs produits et services. Ils apportent de ce fait une contribution notable à l'agriculture durable et la sécurité alimentaire dans la région.

Cette contribution analyse la situation des AHF et leurs tendances dans la région de l'Afrique du Nord. Elle propose une typologie des AHF adaptée à la région en analyse. Les rôles et les enjeux, l'aménagement et la gestion des ressources ainsi que la planification et l'intégration des AHF dans l'utilisation de l'espace et leur dynamique. Des actions sont proposées pour promouvoir les systèmes AHF dans la planification de l'utilisation des terres dans la région.

1- LES AHF : TERMINOLOGIE ET TYPOLOGIE

La définition de la forêt est celle retenue pour la formulation des critères et indicateurs de gestion durable des forêts de la sous-région Afrique du Nord et Proche Orient :

« La forêt est un écosystème à prédominance d'arbres comportant un couvert relativement dense, supérieur à 10% ». Les maquis, les garrigues qui sont des formations végétales formées d'arbres, d'arbustes, d'arbrisseaux et de sous-arbrisseaux touffus, caractéristiques des paysages méditerranéens seront définis par la notion de « terres boisées ».

En raison de la diversité géographique et géomorphologique, de la variété spatio-temporelle des conditions climatiques, mais aussi de la présence ancestrale de l'homme et son impact sur l'évolution des boisements, la distinction des formations ligneuses n'est convenable que d'après leur morphologie générale et les espèces dominantes, en les rattachant à trois domaines phytogéographiques : méditerranéen, sub-méditerranéen et saharien. La classe des « autres terres boisées » englobe une grande partie des formations rattachées à ces domaines (voir encadré 1).

Encadré 1: Types de forêts et de terres boisées au Maghreb.

I. Domaine méditerranéen

- 1.1. Forêts de chênes sclerophylles : *Quercus ilex*, *Q. suber*, *Q. coccifera*
- 1.2. Forêts décidues de chênes méditerranéens : *Quercus faginea*, *Q. afares*, *Q. canariensis*, *Q. pyrenaica*.
- 1.3. Forêts méditerranéennes de résineux :

Forêts de pins : *Pinus halepensis*, *P. pinaster*, *P. nigra*, *P. pinea*, etc...
Forêts de thuya : *Tetraclinis articulata*.
Forêts de genévriers : *Juniperus phoenicea*, *J. thurifera*, *J. communis*.

Forêts de cèdre : *Cedrus atlantica*
Forêts de sapins : *Abies marocana*, *A. numidica*
- 1.4. Formation arborée de l'Oléolenticetum : *Olea europea*, *Pistacia atlantica*, *Ceratonia ciliqua*...
- 1.5. Formation arbustives et buissonnantes : Formation de haute montagne, maquis et garrigues méditerranéens.

II. Domaine sub-méditerranéen

- 2.1. Formations arbustives d'arganier : *Argania spinosa*
- 2.2. Formation arbustives d'acacia : *Acacia gummifera* et *A. tortilis*, *Zizphus lotus*.
- 2.3. Formations steppiques : *Stipa tenacissima*...

III. Domaine saharien : *Acacia sahariensis*, *Maerua crassifolia*, *Balanites aegyptiaca*, *Rhus tripartitum* ; *Tamarix sp.*

La classification des terres dans la région fait état de quatre catégories : (1) terres forestières (2) terres boisées, englobent les matorrals, les steppes d'alfa et les brousses d'acacia, (3) terres comprenant les AHF et (4) autres terres sans AHF.

La description, la structuration et l'appréhension des AHF doit reposer sur une terminologie claire et convenue. La classification doit tenir compte à la fois du couvert arboré (critères biophysiques) et de l'utilisation des sols (critère socio-économique), mais aussi de nombreux facteurs en particulier : (i) la notion d'usage multiple, (ii) la multiplicité des utilisateurs et des bénéficiaires ; (iii) la pression anthropique et le mode de

gestion des terres ; (iv) les questions foncières de propriété de l'arbre et d'accès à la ressource, et (v) la dynamique de la ressource dans le contexte de déforestation, de changement d'utilisation des terres ou d'aménagement du territoire.

Les AHF, définis comme étant les arbres, les arbustes et leurs systèmes situés sur des terres autres que celles définies comme « forêt » ou « autres terres boisées » peuvent être classés, dans la région, en fonction de leur importances spatiales et socio-économique en sept types : (1) pâturages permanents à ligneux ; (2) arboriculture fruitière intensive sous forme de vergers denses, (3) arbres fruitiers dispersés, essentiellement noyer, figuier, grenadier..., dans les bosquets familiaux, (4) plantations de protection forestières, fruitières ou sylvopastorales ; (5) rideaux verts et plantations d'alignement ; (6) les parcs urbains et périurbains et (7) peupleraies.

La catégorie des « autres terres sans AHF », comprend les terres arables, jardin exigü, arbres maraboutiques, haies, berges de cours d'eau, de lac, barrages, etc, où l'on peut toutefois rencontrer quelques arbres dispersés. Le tableau 1 présente l'importance des AHF dans l'utilisation de l'espace dans le cas du Maroc.

Tableau 1 : Les AHF dans l'utilisation de l'espace (cas du Maroc).

CATEGORIE	TYPE	ESSENCES	SURFACE EN HECTARE	SURFACE TOTALE	
FORET (5,51%)	FEUILLUS 2 937 973 ha (74,44%)	Chêne vert	1 414 528	3 946 636 (5,51%)	
		Arganier	871 210		
		Chêne liège	376 701		
		Chêne zéen	9 091		
		Feuillus artificiels	266 443		
	RESINEUX 1 008 663 ha (25,55%)	Cèdre de l'Atlas	133 604		
		Pin maritime, P. noir et Pin d'Alep	82 090		
		Thuya de berbérie	565 720		
		Sapin du Maroc	3 174		
		Résineux artificiels	224 074		
AUTRES TERRES BOISEES (7,12%)		Acacias sahariens	1 011 000	5 091 077 (7,12%)	
		Nappes alfatières	3 318 259		
		Matorral et maquis	761 818		
AUTRES TERRES	Autres terres comprenant des AHF 14 121 294 ha. (19,75%)	Palmier dattier	44 000	860 300	
		Olivier	540 000		
		Agrumes	76 000		
		Rosacées fruitières	200 300		
		Autres fruitiers (Banancier, noyer, figuier, avocatier, ...)			839 053
		Plantation de protection			395 700
		Parcs urbains et périurbains			15 000
		Rideaux verts et Plantation d'alignement			65 000
		Peupleraies			4 500
		Pâturages permanents à ligneux			11 941 741
	▪ Parcours arides (1 931 741 ha)				
▪ Parcours ds hauts plateaux (4 410 000 ha)					
Autres terres sans AHF 67,60%	Autres pâturages à herbacées et sahariens		41 058 259	48 340 993	
	Autres terres (terres arables, incultes, bâties, dunes, lacs et barrages, y compris eaux continentales)		7 282 734		
SUPERFICIE NATIONALE (en hectare)				71 500 000	

NB : les forêts et autres terres boisées constituent le domaine forestier (Sources IFN, 1999)

2- INSTITUTIONS ET LEGISLATIONS

L'espace agricole est structuré en trois statuts fonciers principaux : collectif, privé, et domanial.

- Le privé (*melk*) : comprend les terres appartenant en propre à des individus qui en disposent librement dans le cadre de la propriété privée. On peut assimiler le « *melk* » immatriculé à la propriété privée du droit moderne, alors que le « *melk* » non immatriculé est soumis au droit musulman.
- Le domanial : concerne l'ensemble du domaine forestier de l'Etat (forêts et terres boisées).
- le collectif : dont l'origine remonte à l'époque pré-islamique. Le législateur reconnaît aux occupants des terres collectives un droit de propriété inaliénable.

Dans la pratique, pour les AHF, l'instrument majeure est représenté par les Codes des Investissements Agricoles, en vigueur dans les pays de la région. Ces textes définissent les mesures d'incitation en faveur des opérations de boisements, repeuplement et reboisement en faveur de l'arboriculture fruitière aussi bien en « *bour* » (zone d'agriculture pluviale) qu'en zone irriguée.

La législation sur les arbres hors forêts se manifeste aussi au niveau de la certification des plants et du contrôle des pépinières, dont la responsabilité est confiée au département de l'Agriculture. Les règlements techniques homologués concernent essentiellement les agrumes, l'amandier, l'olivier et la vigne. D'autre part, la commercialisation des plants certifiés est réservée aux établissements agréés par ce département.

Les lois forestières sont organisées autour de la conservation et l'exploitation des forêts :
« sont soumis au régime forestier et administrés conformément aux dispositions de la loi : le domaine forestier, les forêts des collectivités susceptibles d'aménagement ou d'exploitation régulière ; les terrains collectifs reboisés ou à reboiser et les terres de parcours collectives à améliorer par l'Etat après accord du conseil de tutelle des collectivités ; ainsi que les terrains reboisés ou à reboiser et les terres de parcours appartenant à des particuliers, dont les propriétaires entendent confier à l'Etat, soit la surveillance, soit la surveillance et la gestion ».

Par ailleurs d'autres dispositions relatives aux bois et forêts non soumis au régime forestier, aux défrichements et reboisement, fixent les modalités d'exploitation des bois particuliers quelle qu'en soit l'essence et les modalités de soumission au régime forestier des bois, forêts et terrains non domaniaux (collectivités et particuliers).

Un régime particulier régleme les terres de parcours naturels, en majorité de statut collectif, en particulier : les modalités de délimitation des terres collectives, leur régime général et les conditions d'attribution de la jouissance à titre perpétuel. Malgré le caractère inaliénable de ces terres, il existe un ensemble de réglementations pour leur exploitation à titre de baux à long terme ou par concession perpétuelle de jouissance, mais aussi des textes réglementant la transformation des ayants-droit en propriétaires pour les terres collectives situées dans les périmètres irrigués.

D'autres textes beaucoup plus généraux impliquent d'autres institutions dans la tutelle des AHF, en l'occurrence : les départements de l'Agriculture, du Développement Rural et des Eaux et Forêts, de l'Intérieur, des Affaires Islamiques, et des Habous, de l'Aménagement du Territoire, de l'Environnement, de l'Urbanisme et de l'Habitat .

3- ROLES ET ENJEUX DES ARBRES HORS FORET

3.1 Importance économique des AHF

L'intérêt des «arbres hors forêts» se situe dans la mise en valeur des terres agricoles et des terres marginales, mais aussi dans l'agriculture intensive, l'agro-industrie, l'emploi, le transfert de technologie, la protection contre l'érosion, la fixation des dunes et des terres à risque, la réduction des effets des vents, l'équilibre social des habitants, la production et l'amélioration des revenus agricoles.

A l'exception des produits principaux, l'importance réelle des AHF n'apparaît pas à travers les statistiques disponibles qui négligent, à notre connaissance, l'inventaire et l'évaluation des rôles et des utilités auxiliaires ainsi que l'importance des sous produits (feuilles, graines, racines, extraits végétaux, usages domestiques énergétiques, artisanaux, médicinaux, cosmétiques, diététiques, culinaires).

Sur le plan de la sécurité alimentaire, les AHF assurent une importante production fruitière diversifiée (2 805 470 tonnes de fruit brut en 1998/99 au Maroc). Cette production fruitière est essentiellement assurée et dominée par les agrumes, suivis des rosacées, l'olivier, les autres fruitiers dispersés (figuier, noyer, bananier, et autres), le palmier dattier et l'amandier.

Les parcours naturels sont à la base de la production animale du secteur de l'élevage (25 à 30% du PIBA ; 10 milliards de dirhams/an ; 20% de la population active) dans le cas du Maroc. Les AHF, à travers les parcours naturels contribuent pour 30 à 35% (selon les conditions climatiques) dans la couverture des besoins alimentaires du cheptel national.

Sur le plan économique, quoique la production des AHF soit diversifiée, les statistiques disponibles ne permettent pas d'appréhender une véritable quantification de l'ensemble des produits ligneux et non ligneux. Un large éventail de produits sont issus des AHF (Bois et branchage, tanins, écorce, racines et extraits, gousses, boutures de plants, feuilles, fleurs, graines, fourrage, etc.), ou alors ce sont les AHF qui servent à des productions comme le miel ; ou pour servir de support à la vigne (caroubier) ; mais aucune évaluation fiable n'est disponible à notre connaissance.

Les ménages ruraux exploitent et valorisent les produits ligneux aussi bien pour les besoins énergétiques (carbonisation, cuisson) que domestiques dans la fabrication d'outils et de manche, de haie, d'enclos, ou alors dans la construction des foyers et des abris de bétail, ou dans la confection de produits artisanaux (ustensiles de cuisine) et de meubles. Ce sont parfois les racines ou l'écorce qui sont exploitées, que ce soit pour en extraire des tanins (thuya) pour traiter les poches de cuir à lait ou les gourdes en cuir, ou des gommes à usage médicaux ou autre tel l'écorce « *Mesouak* » de noyer utilisée comme cosmétique ou « dentifrice ». Parfois ce sont les fleurs (arbres à fruit non comestible) qui sont récoltées pour être séchées et utilisées dans des préparations (« *héné* ») ou des recettes d'infusion. Certains produits font l'objet de commerce par les femmes, et d'autres participent à la consommation, contribuant ainsi aux revenus des ménages (voir encadré 2).

Parmi les AHF appréhendés, on peut retenir les cultures fruitières et les pâturages permanents comme catégories constituant l'objet de marchés proprement dits en raison des produits auxquels elles donnent naissance. La production fruitière, le lait et la viande rouge sont donc les produits principaux, ainsi que leurs principaux dérivés. Les statistiques concernant le cuir et la laine n'étant pas disponibles.

La mission de contrôle des filières est assurée par plusieurs structures relevant essentiellement de cinq départements ministériels (Agriculture, Commerce et Industrie, Santé, Intérieur, Pêches maritimes). Les filières des produits des AHF se trouvent ainsi en liaison étroite avec ces cinq départements. L'exercice de ces activités repose sur un arsenal juridique important et des entités régionales chargées de sa mise en application.

Encadré 2 : Types de production des AHF

- **Parcours naturels** : la production ligneuse provient des arbustes et des espèces ligneuses telles l'alfa ou l'armoise, ou d'arbres tels le caroubier ou l'oléastre (et d'autres). L'alfa dans les parcours naturels peut atteindre 0,06 m³/ha/an.
- **Vergers fruitiers** : le produit ligneux est obtenu à l'occasion des soins sanitaires (taille et élagage) ou à l'occasion de rajeunissement ou renouvellement des vergers. Cette production est certainement très importante dans la mesure, ou elle est généralement vendue ou carbonisée (Olivier notamment). La production en combustible ligneux des plantations fruitières peut néanmoins caractérisées d'une façon générale à 1,5 m³/ha/an en zone humide et à 0,8 m³/ha/an en zone aride.
- **Palmier dattier** : est un arbre aux multiples vertus, dont les branches et feuilles, fruits et troncs couvrent respectivement la fixation des dunes, la consommation humaine et animale (déchets de dattes), mais aussi la confection d'objets d'artisanats et de matériaux utilisés dans les structures de construction des oasis.
- **Rideaux verts et plantation d'alignement** : il est courant d'assister à des tailles des arbres de bordure de route que les collectivités rurales (commune) exploitent, et qui leur assurent de consistant revenus par d'importantes quantités de bois (Eucalyptus notamment).
- **Plantations de protection** : compte tenu de leur caractère, elles ne font pas l'objet d'extraction ligneuse, néanmoins lorsqu'elles sont fruitières, aucune donnée sérieuse ne peut être avancée.
- **Parcs urbains et péri-urbains** : gérés par les pouvoirs publics, et servent d'espace de loisir et de récréation.
- **Peupleraies** : on distingue deux types d'utilisation. La première traditionnelle concerne les peuplements naturels surtout le peuplier de l'Euphrate et le peuplier blanc, qui sont soit traités en vue d'avoir des poutrelles d'armatures des toits de maison, des feuilles et des rameaux donnés comme fourrage au bétail, et des branches utilisés comme bois de cuisson. La seconde concerne les plantations artificielles et le bois importé en vue de sciages employés dans la petite charpente, la menuiserie courante, le coffrage et la caisserie ; les déroulages utilisés dans l'industrie des contre - plaqués, et les emballages (cageots pour fruit et légume). La production marocaine en bois de peuplier est évaluée à près de 3000 m³ (0,3 % du total produit).

Les AHF fournissent directement ou indirectement une grande part de l'approvisionnement à sept secteurs agro-industriels majeurs représentés par des usines modernes et des unités traditionnelles. Par l'effectif, le secteur des huilerie est de loin le plus représenté, suivi du secteur des viandes rouges (abattoirs municipaux), du secteur frigorifique froid, des conserveries à base de végétaux, et du secteur laitier et dérivés.

Encadré 3 : Infrastructure agro-industrielle liée aux AHF au Maroc

- **Secteur des huileries** : 255 unités industrielles modernes et semi-modernes, d'une capacité globale de traitement de 413 000 tonnes. Le secteur artisanal comprend 16 000 unités artisanales « *Maàsara* », avec une capacité de production de 170 000 tonnes.
- **Conditionnement des fruits et légumes** : 73 unités de conditionnement des agrumes, dont 22 équipées en système froid.
- **Secteur du froid** : la conserverie du froid atteint actuellement une capacité de 315 000 tonnes, ou 1 350 000 m³ pour un total de 480 unités, dont les unités de conserve de légumes et fruits atteignent 259 000 tonnes, et 6000 tonnes destinés aux viandes rouges. Le reste couvre d'autres produits.
- **Conserverie végétal** : le secteur de transformation des fruits et légumes comprend 151 unités de transformation, d'une capacité globale de 350 000 tonnes (conserve de fruit, jus essentiellement)
- **Secteur laitier et dérivés** : 38 unités dont 16 sociétés ayant une capacité de traitement de 1 718 000 litres par jour ; et 22 coopératives laitières de capacité 1 117 000 litres/jour. Ces unités traitent annuellement une moyenne de 615 millions de litre de lait.
- **Secteur des viandes rouges** : Les unités d'abattages sont au nombre de 62 relevant de municipalités, et 750 abattoirs ruraux ; toutes sous-équipées.
- **Secteur de l'alimentation composée** : 37 unités orientées vers l'aviculture ; elles ont enregistré une capacité de production de 3.5 millions de tonnes en 1998. La production est estimée à 1,3 millions de tonnes, essentiellement à base de maïs (50-60%).

La biomasse énergie se trouve actuellement au centre des préoccupations des responsables et des usagers de cette ressource énergétique. L'approvisionnement en énergie est assuré à travers deux filières. Une filière conventionnelle qui met sur le marché des énergies conventionnelles (pétrole, gaz, électricité); caractérisée par la prépondérance des produits pétroliers. La filière commerciale formelle couvre le bois officiellement exploité et vendu sous le contrôle de l'administration forestière; ou *informelle* échappant au contrôle des services forestiers et de la statistique. La consommation totale de bois-énergie se répartit en fonction de trois catégories : bois fruitiers, bois de feu de la forêt et résidus solides et déchets d'huileries. Dans le cas du Maroc, la consommation annuelle de bois - énergie totale représente 30% du bilan énergétique nationale, soit (3 617 000 Tep).

3.1.2 Rôle environnemental

En matière d'environnement, les AHF représentent certainement l'intérêt le plus pertinent. A côté de la production des fruits, on peut enregistrer la défense et la protection des terres comme fonction prééminente remplie par les AHF. En effet, sur l'ensemble de la surface des AHF, la grande majorité peut être classée comme boisement et plantation de protection dans la mesure où ils concernent des terres de montagne ou des terres marginales, et dans une moindre mesure des terres « *bour* », ou alors la protection des infrastructures urbaines.

La conservation des sols dite « défense et restauration des sols » (*DRS*) a pris une importance particulière comme principale activité du département chargé des Eaux et Forêts et de la Conservation des Sols dès 1950. Les textes ont pour objectifs principaux : la protection de sols contre l'érosion hydrique et éolienne ; la conservation des eaux et l'amélioration de la productivités des terres en pente ; la protection des infrastructures socio-économiques contre les effets de l'érosion ; et l'amélioration des revenus des agriculteurs. Deux modalités d'interventions ont été prévues par cette législation :

- Dans le cas où l'érosion présente une menace pour la collectivité, les zones affectées sont déclarées « périmètres d'intérêt national » (*PIN*) ; à l'intérieur desquels l'intervention de l'Etat peut devenir obligatoire.
- Selon un régime contractuel, l'Etat apporte son concours aux propriétaires privés, et aux collectivités qui le sollicitent, sous forme d'exécution des travaux de défense et restauration de sols, et d'octroi de subventions.

Le rôle des rideaux abris et ceintures vertes, à cheval entre l'intérêt social et environnemental, a trait à la protection des terres et infrastructure, à l'amélioration du paysage des villes, à la protection des centres urbains contre les vents, le sable, l'érosion, la dépollution de l'atmosphère, et à la récréation, au divertissement, et à la détente.

Dans cette catégorie, il est important de citer les axes routiers boisés qui jouent une fonction importante en faveur des voyageurs routiers et conducteurs. Qu'ils soient boisés en simple alignement de part et d'autre de la route, en rideaux verts ou en large bande de forêt, ils pourvoient les voyageurs d'ombre pour leurs longs voyages en périodes chaudes et en stations agréables pour les arrêts de repos. La région étant chaude, ces doubles alignements agrémentent les paysages ruraux également, créant des repères dans les paysages ouverts et luttent contre l'érosion. Ces arbres, situés souvent dans des fossés, bénéficient d'assez d'eau pour avoir des dimensions intéressantes pour en exploiter le bois.

Encadré 4 : Biodiversité des AHF au Maroc

L'état actuel de la diversité et des profils variétaux des arbres hors forêt peut être résumé comme suit :

- **Le palmier dattier** (*Phoenix dactylifera* L.) est une monocotylédone pérenne thermophile. La composition variétale du patrimoine phoenicicole est caractérisée par une forte proportion de « *Khalts* » (47,5% : variétés non identifiées). Parmi les variétés les plus intéressantes, on cite particulièrement « *Mejhoul* », « *Boufeggous* », « *Bouskri* », « *Jihel* » et *DeglitNour*. Cependant, la grande diversité du profil variétal est à l'origine de l'hétérogénéité de la production dattière ; sachant pertinemment qu'un grand nombre de variétés existantes sont issues de semis et présentent une qualité dattière relativement médiocre.
- **L'olivier** (*Olea europaea*) joue un rôle socio-économique important dans la région, présent dans les différents milieux et sous des climats régionaux contrastés. Il est l'une des plus anciennes cultures agricoles arboricoles. Malgré l'importance des éléments, des résultats plus récents (Ouazzani et al., 1997) citent les variétés « *Noukal* » de Taza, « *Bouchouika* » de Sefrou, « *Souissia* » de la région du Souss et « *Meslala* ». Plus récemment, il est important de souligner l'existence de la variété « *Dahbia* » de la région de Meknès, ainsi que « *Menara* » et « *Haouzia* » de la région de Marrakech.
- **Les rosacées fruitières** constituent le secteur qui a le plus bénéficié des encouragements cités auparavant. Depuis 1980/81, le secteur a connu une forte et constante extension des superficies.
- **Les agrumes**, présentent un capital variétal plus d'une vingtaine de variétés sur l'ensemble des vergers agrumicoles dont *Clémentine*, *Navel*.
- **Les parcs urbains, périurbains, rideaux verts et axes routiers**, et dont la diversité des espèces comprend des arbres forestiers plantés ou conservés à partir de formations naturelles préexistantes, et des arbres ornementaux et forestiers plantés des mains de l'homme.
- **Les parcours naturels** présentent des potentialités offertes par la végétation des écosystèmes pastoraux marocains, tant sur le plan phyto-génétique que sur celui de la capacité productive ; terres de parcours (y compris les faciès forestiers) intègrent une grande diversité de milieux écologiques et une richesse floristique relativement élevée à l'échelle de la région.

3.1.3 Importance socio-culturelle

Sur le plan social, les AHF représentent dans plusieurs zones l'activité principale de la population rurale ; ils contribuent à la création d'emplois dans les zones sans activités industrielles, permettant ainsi à la population la réalisation de revenus et la subsistance de nombreuses familles dont les moyens d'existence reposent sur l'exploitation des fruits, des cultures sous-jacentes et des sous-produits que ces arbres prodiguent dans des milieux variés. Les AHF génèrent ainsi d'importants emplois évalués dans le cas du Maroc à 60 millions Homme/Jour/an dans le secteur des arbres fruitiers et un million dans la palmeraie. Les emplois créés sont ceux liés non seulement à la production de fruits frais, mais à l'ensemble des filières et des circuits commerciaux, à la transformation et au conditionnement des produits frais ou dérivés (non compris les emplois permanents par défaut de statistiques).

Les conditions naturelles de la région, ont toujours fait que l'arbre en dehors de la forêt fasse partie du culturel aussi bien des citadins que des ruraux, en témoigne l'olivier, et l'amandier, mais également le grenadier, et d'autres en raison de leur citation dans les versets du « *Coran* ». L'arbre exprime de ce fait l'expression de valeurs religieuses dans la culture arabo-musulmane. Il est également impliqué dans de nombreux rites au niveau des boisements et des bosquets maraboutiques, où les arbres, liés à l'esprit du défunt enterré au niveau de la « *Zaouia* » (cimetière de marabout), bénéficient du respect des visiteurs.

Sur un autre plan, les AHF rentrent également dans l'élaboration de produits alimentaires de grande valeur énergétique et diététique liées à des comportements socio-culturels ou religieux et rituels. Au niveau urbain et périurbain, les AHF améliorent le cadre de vie, comme facteur d'équilibre social et environnemental, contribuant ainsi au développement de l'urbanisme et de l'infrastructure.

L'importance socio-culturelle des AHF se confond dans sa notion avec celle de la valeur terre. La fonction de la terre est largement considérée par les ruraux comme « valeur refuge ». Les comportements sont déterminés aussi bien par des considérations de sécurité et d'appartenance à un groupe ou à un lieu que par sa valeur économique. Ils peuvent refuser de vendre une parcelle alors qu'elle ne rapporte plus rien pour continuer, grâce à elle à faire partie d'une collectivité ou d'une famille.

Les motivations socio-culturelles pour la plantation et l'entretien des arbres trouvent leur expression dans le statut social qu'offre l'existence d'arbres sur sa terre ou « *bled* ». La terre plantée est signe distinctif de prospérité, de sécurité financière, et de marque du domaine de la propriété. C'est également un signe de valeur de la propriété en raison sous-entendue de l'existence de l'eau (ou puit) comme valeur déterminante dans les rapports sociaux, mais aussi en raison des valeurs tangibles que procurent les arbres et leurs produits ligneux et non ligneux (fruits et autres). C'est également signe de confort et de cadre agréable, d'intimité, d'ombrage et de protection dans des pays réputés chauds comme le Maghreb. L'arbre représente un repère, une limite ou un abris.

Le palmier dattier, par exemple, est considéré comme l'une des plus vieilles espèces fruitières de la région. La culture du palmier dattier, symbole de fertilité et aussi de prospérité des zones saharienne et pré-sahariennes, constitue l'une des principales spéculations agricoles au niveau de ces zones. Il présente également un intérêt d'ordre agro-touristique dans le maintien de l'identité écologique de son environnement (cas de la palmeraie de Marrakech et du tourisme des oasis).

L'accès à la ressource terre par contre (vente ou prise à bail) est très peu actif. La vente est très faible. Le mode de faire-valoir indirect reste faible également. De plus, une partie de ce mode de faire-valoir indirect ne rentre pas dans une véritable mobilité du facteur terre car il concerne les locations, prêts et fermages à l'intérieur de la famille, à des voisins ou clients selon un critère qui relève plus de la confiance (inter-connaissance) que du marché (niveau du loyer).

Le contrôle sur les opérations foncières est marqué par des rigidités juridiques. Les terres collectives sont, sauf exception légale, inaliénable, et leurs locations sont contrôlées. Les terres « *Melk* » (privé) sont, en principe, libres à la vente et à la location. Mais la quasi généralisation de l'indivision familiale rend les ventes très difficiles.

4. AMENAGEMENT ET GESTION DES AHF

4.1. Savoir vernaculaire et connaissances locales

La richesse culturelle et le savoir-faire des agriculteurs et des paysans (irrigation, résistance à l'aléas climatique...) a été souvent le vecteur de progrès dans la région. Mais la force du savoir-faire paysan, qui fait partie d'une longue et ancestrale tradition, est la capacité associative et solidaire du monde rural : « *jmaâ* » villageoises (groupement ethnique), associations traditionnelles d'irrigateurs, pactes pastoraux entre tribus et fractions.

L'exemple de l'exploitation des parcours naturels constitue un savoir traditionnel intéressant, quoique perturbé par de nombreuses contraintes récentes d'ordre juridique et organisationnelles. Néanmoins, l'activité pastorale demeure encore beaucoup plus un mode de vie qu'une activité purement économique. Ce système est intimement lié aux conditions historiques, sociales et aux valeurs et institutions traditionnelles.

Les principes du mode de fonctionnement du système pastoral se caractérisent à priori par un troupeau polyfonctionnel (viande, laine, produits laitiers pour l'autoconsommation, source de monnaie d'échange), et correspond à un statut social. La recherche du plus grand troupeau possible est la règle ; ce qui encourage toute forme d'association. Les troupeaux ; exploitent le parcours selon deux grandes règles : le nomadisme et la transhumance. Ces mouvements sont réglementés par voie ancestrale établie entre les différentes tribus. C'est une forme complexe, mais judicieuse d'exploitation des potentialités des ressources végétales, où la forêt et les AHF jouent également un rôle primordial de survie du cheptel en période de disette.

4.2. Savoir scientifique et connaissances des services institutionnels

D'une façon générale, le transfert de technologie, ou vulgarisation est mené par un ensemble de structures, certaines à caractère national, d'autres à caractère régional ou local relevant du Département de l'agriculture. Cette fonction est assurée par des centres de développement et de la mise en valeur. En principe un Comité National de Transfert de Technologie et des Comités Régionaux assurent la coordination entre les différents partenaires de la vulgarisation.

Des organisations professionnelles agricoles, des associations à caractère national et à caractère régional couvrent divers secteurs d'activités articulés autour soit des produits (fruits et légumes, semences et plants...) soit des services, soit des actions de développement agricole local. Le secteur coopératif agricole reste, toutefois, peu développé dans les régions difficiles, et ne concerne que marginalement les produits agricoles et forestiers locaux.

Le savoir scientifique et les connaissances des services institutionnels en matière d'AHF ont principalement trait à l'amélioration génétique et la sélection clonale, aux itinéraires techniques, à la culture des arbres, ainsi qu'à la valorisation des produits.

Les espèces à usage multiples, par exemple, ont déjà fait l'objet d'études et d'essais d'introduction et sont maintenant utilisées à plus ou moins grande échelle. Jusqu'à présent, l'acacia, l'atriplex, le cactus, l'arganier, et récemment le caroubier sont les genres ayant fait l'objet de travaux importants parmi les AHF. Leurs techniques d'installation et d'aménagement sont à présent plus ou moins connues. Certaines, tels le cactus, le caroubier ou l'acacia ont été adoptées par les populations elles-mêmes en raison des produits et des services qu'elles leur procurent.

Les ligneux constituent une source importante de fourrage naturel sous forme de feuilles branche et fruits (gousses), riches en protéines, minéraux et vitamines ; pertinents surtout durant la saison sèche, puisqu'ils sont mieux adaptés que les plantes annuelles. L'absence du fourrage de bonne qualité pendant la saison sèche demeure une contrainte sérieuse à la production animale. Le rôle vital et complémentaire des ligneux dans l'alimentation du bétail est maintenant bien reconnu, quoique beaucoup reste encore à faire pour élargir la gamme d'espèce actuellement utilisée et déterminer la meilleure combinaison d'espèces et leurs techniques d'aménagement et d'exploitation.

Les espèces à usage multiple présentent également une source inestimable de produits non ligneux : fruit, produits pharmaceutiques, huiles essentielles, goudron et tanin. De nombreux ligneux sont producteurs de pollen et/ou de nectar apprécié des abeilles tels *Casuarina s.p.*, *Tamarix*, *Gleditsia*, *Rosmarinu* ; et la plupart des acacias, mais aussi de nombreux eucalyptus. Plusieurs espèces donnent des fruits comestibles (caroubier, cactus,...), et des graines (pin pignon, pin d'Alep), ou des extraits tels l'huile de *Rosmarinus officinalis* et *Artemisia herba alba* qui servent à la fabrication de produits pharmaceutiques et cosmétiques.

Certaines espèces sont riches en tanins notamment *Tamarix aphylla* (50% de rendement), l'écorce de *Eucalyptus astringens* (40 à 45%), *Rhus tripartita* et ses racines (28%). *Tetraclinis articulata* fournit de la gomme pour des produits pharmaceutiques et vernis. *Juniperus phoenicea* peut donner des produits pharmaceutiques et aussi des produits pour la fabrication du savon. *Argania spinosa* produit 8 à 10 kg/ha d'huile pour l'alimentation, et 100 kg de fruit produisent 1 kg à 1,800 kg d'huile.

4.3. Etude de cas : Développement intégré du Rif Marocain (Province de Chefchaouen)

Le développement intégrée des zones forestières et périforestières de Chefchaouen s'inscrit dans le cadre de la stratégie du programme forestier national (PFN) et de la politique gouvernementale en matière de développement rural. Il s'appuie une approche patrimoniale, territoriale et partenariale d'une part, et d'autres parts sur une vision d'aménagement global et intégré du territoire afin de procurer les effets de synergie des actions et optimiser les ressources financières.

**Encadré n° 5 : Aménagement et gestion des Arbres hors forêt
Développement intégré du Rif marocain (Province de Chefchaouen)**

La conception des interventions est basée sur les éléments suivants :

- ⇒ **Classification de la province en six pôles agro-écologiques** en fonction de l'occupation du sol, du système de production et du niveau de dégradation.
- ⇒ **Élément de programme :** (1) planification participative, (2) protection et gestion des forêts, (3) aménagement du Parc National de Talassemtane, (4) amélioration des systèmes de production agricole en périphérie des forêts, (5) infrastructure.
- ⇒ **l'intégration des actions de développement et de gestion des ressources naturelles par pôle.** La raison consiste à favoriser une synergie entre les différentes composantes du programme et l'émergence de pôle de développement autour d'un noyau (forêt, PMH, AHF,...). La gestion des espaces agricoles et forestiers sera conçue de manière complémentaire et particulièrement les AHF.
- ⇒ **La promotion d'une approche participative** basée sur la consolidation des compétences, des intérêts et du savoir des capacités locales. Les collectivités seront considérées comme de véritables partenaires, avec lesquels devront être définis les divers programmes de développement.
- ⇒ **La concentration des actions dans le temps et dans l'espace**, de manière à assurer un impact direct et rapide sur les conditions de vie des populations.
- ⇒ **Une planification souple**, qui doit permettre aux populations et à leurs organisations (ainsi qu'aux autres intervenants) l'occasion de participer réellement aux différentes phases du projet.

5. PLANIFICATION ET INTÉGRATION DES AHF DANS L'UTILISATION DE L'ESPACE.

Les acteurs liés à la prise de décision concernant la promotion des AHF sont multiples et variés, essentiellement les autorités gouvernementales (Agriculture, Intérieur, Urbanisme, Environnement, Travaux Publics...), Le Conseil Général de l'Agriculture, le Conseil national des forêts. Les chambres professionnelles d'agriculture et les ONG sont également plus ou moins impliquées. À côté de ses institutions, il y a lieu d'insister sur la contribution du secteur économique agricole, notamment les « grandes exploitations » à dominante de production fruitière, ou l'industrie de pâte à papier.

Les mécanismes de négociation se traduisent par des conventions et contrats, où l'appui financier fait intervenir partiellement de nombreux fonds aussi bien étatiques que semi-publics (Fonds Forestier National, Fonds de Développement Rural, Fonds de Développement Agricole, Fonds d'Équipement Communal, etc). Généralement, la terre vient des particuliers ; la technologie, le matériel végétal proviennent de l'État à des taux variables selon le cas.

L'intégration des arbres hors forêts s'insère dans le cadre d'un certain nombre de stratégies et de plans mis en place au niveau national, et qui traduisent la volonté de l'État d'accorder une attention particulière à la préservation des ressources naturelles. Leur trait commun s'attache à la lutte contre la dégradation des ressources et à la promotion des espaces boisés, en l'occurrence les arbres hors forêts. Il s'agit notamment des Plans nationaux d'aménagement des bassins versants, de lutte contre la désertification, de reboisement, des aires protégées, des stratégies de développement des parcours, des Plans de gestion conservatoire des terres Agricoles, des programmes forestiers nationaux et des Stratégies de développement rural.

Le cadre de contrôle et de suivi non seulement de l'ensemble des politiques agricoles, mais aussi des systèmes AHF se traduit par les enquêtes et recensement agricoles. Le Département de l'Agriculture réalise périodiquement des enquêtes par sondage, relatives aux productions végétales et animales. Ce système est actuellement constitué d'enquêtes statistiques à échantillons aléatoires, d'informations fournies par d'autres administrations (statistiques sous-produites de leurs activités courantes), d'estimations faites par des experts, et d'une manière plus exhaustive du recensement général de l'Agriculture (RGA).

La mise en œuvre du RGA se présente en deux étapes : recensement de l'ensemble des exploitations avec un questionnaire succinct, et enquête approfondie d'un échantillon représentatif des différents types d'exploitations. Cette option permet de bénéficier des avantages du recensement exhaustif (constituer du fichier de l'ensemble des exploitations et recensement des cultures de petites étendues), et ceux du recensement par sondage (rapidité d'exécution et économie des moyens mis en œuvre). Le critère de stratification retenu est *l'utilisation des terres*.

6. TENDANCES ET DYNAMIQUES DES AHF

Les dynamiques ne sont apparues qu'avec la grande irrigation (politique des barrages), et le code des investissements agricoles. Les mesures d'incitation à la création des vergers ont induit une véritable révolution arboricole, avec en parallèle le développement des pépinières, des soins et des traitements.

Les données sur l'évolution sont peu fournies d'une manière globale ou exhaustive, et les statistiques ne couvrent que certaines espèces, ou certaines dates correspondant généralement aux principaux recensements généraux de l'agriculture. Le secteur privé est peu fourni en particulier. L'information disponible ne pouvant permettre une synthèse cohérente. Les agrumes ont également été favorisés par les mesures d'incitation, mais aussi par le développement de la grande et moyenne hydraulique, ainsi que le développement du marché des exportations et de l'industrie agroalimentaire.

Compte tenu de l'intérêt des AHF, notamment les fruitiers, et des conditions de la région qui ont de tout temps permis l'introduction et l'adaptation d'une gamme élargie d'espèces fruitières allant des plus rustiques et des mieux adaptées (olivier, figuier, amandier) aux espèces d'introduction plus récente nécessitant des soins plus intensifs (pommier, poirier, cerisier,...), ce secteur a bénéficié de nombreux encouragements ayant constitué un véritable « levier de commande » pour stimuler une révolution verte arboricole par la création de vergers tant en culture pluviale (*bour*) qu'en irrigué.

Ces introductions ont permis la constitution d'importantes collections dans plusieurs stations expérimentales et diverses zones de la région. Les prospections engagées sont arrivées à la sélection de clones plus performants de l'olivier (ex : Picholine marocaine), à la sélection d'hybrides naturels de dattiers, résistants ou tolérants au « bayoud » (*Fusarium oxysporum* F.), ainsi qu'au repérage de clones de figuier et d'amandier plus productifs.

Ces dernières années, le patrimoine fruitier s'est enrichi d'espèces et de variétés soit déjà existantes, soit nouvellement cultivées comme le Bananier, le kiwi, l'Ananas ou le Nashi. Une meilleure connaissance des aires écologiques de culture, un renouveau au niveau de la profession de pépiniéristes et d'arboriculteurs stimulés par une conjoncture économique favorable et par une politique agricole dynamique, ont fini par façonner le paysage fruitier en lui assurant une dimension et des perspectives nouvelles.

La contribution des plantations à l'extension du peuplier est fragmentaire dans la mesure où la majorité de ces plantations a été réalisée par l'administration forestière (Etat). Un rythme lent marque l'extension de ces plantations et, presque la totalité du bois de peuplier fait l'objet d'importation.

L'évolution des tendances s'oriente vers l'adaptation des codes de développement agricole et rural à une intervention publique d'investissement et d'incitation en rapport avec les concepts de développement durable. De nouveaux principes de base sont définis tels la multifonctionnalité de l'agriculture, l'intégration des actions, la contractualisation des relations entre les différents opérateurs publics ou privés du développement dans le cadre d'un partenariat actif, la durabilité du développement, la régionalisation et la territorialisation des politiques, la promotion de la qualité, la régulation des métiers, des professions et des procédures.

7- CONCLUSION ET RECOMMANDATION

7.1. Conclusions générales

D'une manière générale, Le secteur des AHF, intimement lié à la terre est marqué par la faible taille des exploitations, le morcellement des terres et de la propriété. A l'exception des Inventaires Nationaux, l'inventaire AHF n'existe pas quoique les catégories d'AHF aient fait l'objet de recensements ponctuels. Ces contraintes générales ne permettent pas l'émergence d'unités de production viables et économiquement rentables. Selon les systèmes d'AHF considérés, les spécificités particulières se manifestent comme suit :

- (i) Les besoins de production de bois de service, du bois énergie et bois d'œuvre, connaissent encore des difficultés en rapport avec la faible production des espèces locales ou introduites utilisées. Beaucoup reste à faire pour améliorer les techniques de pépinière et de plantation, mettre au point des techniques d'entretien, améliorer le matériel végétal.
- (ii) Energie de biomasse est confrontée à l'accroissement des besoins en combustible allant de paire avec celui de la démographie, à l'absence de possibilités matérielles et financières de fournir des produits de substitution à temps (à l'exception de l'Algérie et de la Libye) et surtout à la dégradation du milieu, et de ses équilibres éco-sociologiques.
- (iii) Le secteur phoenicicole reste sujet au *Bayoud* (maladie cryptogamique) responsable de la destruction de plus des deux tiers de ce patrimoine, à l'insuffisance des ressources hydriques et des conditions de sécheresse, mais aussi à la désertification et l'ensablement qui menacent les régions de production.
- (iv) Pour le secteur de l'olivier, les rendements moyens actuels ne représentent que 15% à 20% en bour et 30% à 40% en irrigué des rendements potentiels obtenus au niveau des stations expérimentales. L'incertitudes des conditions climatiques, la complexité des statuts juridiques des terres, la dispersion et l'irrégularité des plantations, le matériel génétique peu performant, et les pratiques culturales peu évoluées demeurent des contraintes à lever. L'enclavement et l'éloignement des zones de production et le manque d'organisation professionnelle sont particulièrement à l'origine des problèmes de collecte des olives, d'approvisionnement des unités de transformation et de technologies d'élaboration des huiles d'olive et des olives de table.
- (v) La production de fruits de rosacées, exposée également aux aléas climatiques, connaît des fluctuations assez marquées qui se traduisent par des risques importants pour les producteurs. Généralement, les petites exploitations atteignent un rendement faible, doivent faire face à un prix de revient relativement élevé et réalisent donc une marge brute modeste par rapport aux grandes exploitations. Les raisons relèvent pour l'essentiel de l'application d'un itinéraire coûteux (trop de traitements), ou de l'utilisation inappropriée des facteurs de production (gestion inadéquate de l'eau), et ou bien l'approvisionnement en matériel végétal peu performant.
- (vi) En matière de peuplier, la contribution des plantations à l'extension des AHF est fragmentaire dans la mesure où la majorité de ces plantations a été réalisée par l'administration forestière sur des terres liées à la présence de l'eau. Un rythme lent marque l'extension de ces plantations en raison de leurs exigences en eau. La popiculture reste ainsi fragmentaire et presque la totalité du bois de peuplier fait l'objet d'importation.
- (vii) En matière de parcours naturels, l'ampleur des parcs pastoraux et l'ambiguïté des textes juridiques, la dépendance vis-à-vis des parcours de toutes les espèces animales sous les divers systèmes de production, ainsi que la notion de droit de parcours (droit d'usage) rendent aléatoire l'organisation de l'exercice et le développement du parcours. Les ressources pastorales sont inégalement exploitées ; certains faciès souffrent de sur-exploitation, d'autres de sous-exploitation.
- (viii) Le recensement de l'agriculture et les enquêtes statistiques correspondent à un découpage valable pour les besoins des structures d'intervention du Département de l'Agriculture. Ils ne correspondent pas souvent aux besoins des projets de développement dans des zones qui chevauchent entre différentes zones d'interventions (cas des projets intégrés), ou à ceux des communes rurales, et des opérateurs économiques. Par ailleurs, les enquêtes donnent des résultats très fiables en ce qui concerne les spéculations agricoles à grande échelle (céréales et légumineuses...), mais leur fiabilité reste faible pour les cultures dont les superficies sont limitées, localisées ou dispersées (cas des AHF dans de nombreuses régions).

7.2. Recommandation

7.2.1. Développement des méthodes d'inventaires

- (i) Le système d'information statistique doit fournir des données à une échelle plus fine (cas par exemple des sous-produits, des menus produits et des services (fonctions) assurés par les systèmes AHF), avec une précision raisonnable permettant l'évaluation des nombreuses activités à des niveaux géographiques fins. Un effort important est nécessaire pour étendre le système d'informations statistiques actuel afin d'appréhender les domaines non encore couverts, atteindre des niveaux géographiques plus bas (commune rurale), les cultures ne couvrant que de petites surfaces, et améliorer la fiabilité des enquêtes actuelles.
- (ii) L'appui des supports de la télédétection (format cartographique des données) et des systèmes d'information géographique doit être intégré et soutenu pour servir au suivi (évaluation et planification) des superficies des exploitations agricoles, des spéculations, de l'extension urbaine et de la gestion des risques et des aléas naturels.
- (iii) Un inventaire de la ressource AHF (base de données numériques et cartographiques) sous ce concept s'avère indispensable (en termes de surfaces, produits et dérivés, et liens intersectoriels) afin qu'il puisse pleinement répondre à ses objectifs. Les raisons de cet inventaire se justifient sur l'intérêt économique, social et environnemental, et l'importance des liens avec de nombreux secteurs vitaux pour le Maroc.
- (iv) La vulgarisation de l'information statistique (bases de données) doit être élargie à l'ensemble des acteurs du développement, aux opérateurs économiques et accessible aux populations à moindre coût.

7.2.2. Institutionnel et politique

Les AHF parmi d'autres ressources naturelles et agricoles, sont au centre des préoccupations des **Stratégies pour le Développement Rural**, dont l'objectif central s'insère dans la création d'un environnement porteur susceptible d'ouvrir toutes les possibilités de croissance économique et de bien être des populations. Ces stratégies reposent dans leurs lignes directrices sur les principes de « territorialisation », d'intégration et de participation, mais doit aussi reposer sur les instruments et moyens de leur mise en œuvre, :
en l'occurrence les instruments :

- (i) institutionnels pour soutenir localement le développement rural ;
- (ii) socio-juridiques pour mieux gérer les problèmes fonciers, budgétaires dans le but d'une gestion optimale des fonds publics affectés au développement rural ;
- (iii) financiers adaptés aux besoins du développement rural ;
- (iv) financement international pour des engagements à long terme pour le développement rural ;
- (v) intermédiation et conseil en matière de programmation participative, de suivi et d'évaluation adaptés ;
- (vi) formation et d'information pour une valorisation des ressources humaines.

7.3. Intégration multi-sectorielle dans la planification de l'utilisation des terres

- (i) Les stratégies de développement agricole ont introduit un nouveau mode d'organisation du développement selon une approche territoriale visant ainsi une prise en considération des unités géographiques et humaines réelles qui correspondent aux « aires primaires de polarisation économique. L'intégration doit partir d'une compréhension du milieu rural, d'une identification, avec les intéressés des besoins et des priorités de développement et enfin d'une formulation concertée des programmes d'action et de leurs interrelations
- (ii) L'approche participative dans les programmes d'action constitue l'assise de l'action politique de développement dans cette stratégie. Elle a pour objectif de responsabiliser les acteurs (identifiés) du développement au travers de mécanismes leur permettant d'effectuer eux-mêmes les choix programmatiques, puis d'avoir un contrôle des ressources affectées aux actions décidées, et les moyens d'évaluer les résultats des actions entreprises.

- (iii) Les politiques, mettant l'accent sur les AHF, doivent concerner les domaines essentiels suivants : l'aménagement de l'espace agricole, les filières végétales et animales, la recherche agronomique, la formation et le transfert de technologie, le financement et les incitations, la gestion et la promotion de la qualité, l'organisation professionnelle.
- (iv) En matière de parcours, les petits éleveurs n'ont pas les moyens de recourir à une alimentation complémentaire coûteuse, ni de déplacer leur cheptel vers d'autres régions en cas de sécheresse ou d'insuffisance des parcours. La diversité des milieux offre des possibilités de complémentarité intra-zone et inter-zones, qui ne sont que partiellement exploitées. La possibilité de palier cette contrainte constitue ainsi des atouts sur le plan de la capacité productive, et surtout, dans l'atténuation des effets de la rigueur du climat dans l'année, mais aussi et surtout durant la sécheresse.
- (v) La mise en œuvre des Plans pour la restructuration et le développement de la palmeraie doit être basée, d'une part, sur l'intégration des actions de développement afin d'harmoniser les interventions des différents partenaires au niveau de la filière et d'autres part, sur la promotion de l'approche participative et du partenariat visant l'implication des différents intervenants de la filière et l'organisation des phoeniculteurs bénéficiaires, en coopératives, en groupements ou en associations professionnelles. Les programmes doivent s'articuler autour de la poursuite et du renforcement des travaux de recherche et de transfert de technologie, de la mobilisation des potentialités et amélioration du contexte de production, de la valorisation de la production et de l'amélioration des conditions de commercialisation des dattes.
- (vi) Les programmes d'action en faveur de l'olivier viseront, en priorité, l'extension des superficies, l'accroissement de la production, l'amélioration de la qualité, la promotion des exportations. Ces actions contribueront, de surcroît, à l'amélioration du revenu des oléiculteurs et auront des retombées positives sur la conservation des sols et la lutte contre l'érosion.

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Expert Consultation on Enhancing the Contribution of Tree Outside Forest to Sustain Livelihoods

Tree Outside Forest issues in Africa, with an overview of Research carried out, institutional experiences and existing networks and regional initiatives on agroforestry

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ABSTRACT

In Africa, Trees Outside Forest are disappearing for ecological, economic and socio cultural condition. Many studies on Tree Outside Forest issues have been carried out in many countries. Projects on those issues are being under taken around the world. To identify, compare and facilitate harmonization of approaches, the Food and Agricultural Organization (FAO) of the United Nations decided to organize an international expert meeting in Rome.

This paper presented in the above meeting is dealing with TOF issues in West Africa based on Senegalese experience with an overview research carried out, institutional experience and existing regional networks on Agroforestry.

TOF may be considered as natural or artificial plants growing outside forest, generally in farmed lands, Pasture lands, Fallows, along roads and littoral, in inhabited urban and rural areas, home gardens, sacred forest, etc... They are generally protected for goods (wood, food, fodder; etc ...), services (soil fertility improvement, watershed protection, river bank protection Chad and shelter, ornamentation, road protection, etc...), medicine and socio-cultural purposes. Despite these multiple roles, TOT management is facing in Africa many difficulties.

To mitigate those constrains, National Development Services, Non Governmental Organizations (NGO's) and National Research Institute shifted from conventional forestry approach that failed to take into account local knowledge and population interests, to rural/social forestry and agroforestry.

In West Africa, the International Center for Research in Agroforestry (ICRAF) through its SALWA (Semi Arid Low lands of West Africa) network is conducting in four (4) sahelian countries (Burkina Faso, Mali, Niger and Senegal) strategic research to reinforce Tree Outside Forest potentials to sustain livelihood and food security.

I - INTRODUCTION

Forest and tree covert are declining at an alarming rate in the developing countries, in general and particularly in the sahel where the destruction of the natural ecosystem resulted from the combination of many factors such as: the long drought of the last thirty years, the introduction of inadequate agricultural technologies to increase cash crops (Gelar 1982), an increased demand for wood energy in relation to population increase and inadequate agricultural policy that failed to integrate farming, tree products and livestock enterprises (Agroforestry today

1989). As a result, essential resources of food, fuel, shelter, fodder, medicine and many other forest products are disappearing and the soil and water base for the food production is being degraded. (Chasin and Franke, 1983 ; Freeman and Fricke, 1983)

These unfavorable ecological, economic and socio cultural conditions affected significantly Tree Outside Forest survival and sustainability. Conscious of this danger, many african countries shifted from convention forestry that failed to take into account population needs and local knowledge , to rural/social forestry and agroforestry. This new forestry approaches were highly investigated by National Agricultural Research Centers, and International Research Institutes (ICRAF) to improve the related technologies.

Many studies on Tree Outside Forest have been carried throughout the world to better understand the issues using different approaches Most of them were funded by FAO which finally decided to organize in Rome, November 2001 an international expert meeting to identify, compare and facilitate harmonization of used approaches.

This paper deals with Tree Outside Forest in Africa, particularly in west Africa. It describe firth the issue (definition, classification, localization, tenure system and constrains to sustainability), highlight institutional experiences and regional initiatives and finally gives conclusion makes recommendations.

II – TREE OUTSIDE FOREST ISSUES IN AFRICA

2.1. DEFINITION

Tree Outside Forestry can be defined as natural or artificial plants growing outside forest, generally in farmed lands, pastures lands, fallows areas, along roads, in inhabited urban and rural areas, homegardens sacred forest, mangroves etc.... They are generally protected for :

- goods, (wood, food, fodder, etc...);
- services (soil fertility improvement, watershed protection, shade and shelter, ornamentation, road protection, bank protection, etc...);
- medicine and
- socio - cultural purposes

2.2. LOCALIZATION

In most African countries, particularly in Senegal, there are three (3) major types of land property where trees are grown : (i) National property; (ii) puplic property and (iii) private property.

2.2.1. National property is subdivided into three (3) zones :

- **villages zones** are regularly cultivated or grazed;
- **pioneers zones** comprise essentially classified forests, sylvo- pastoral reserves, planted areas, national parks, etc... These areas are generally protected to enhance production and biodiversity and
- **urban zones** are managed by municipalities for urban development.

2.2.2. Public property is represented by seas, rivers, lakes, roads, railways public places, mangrove, etc....

2.2.3. Private property belongs to governments or individuals. This type of land is generally registered and has license.

Specific rules are used to manage each of these properties. In fact, urban, pioneers and classified zones are generally managed by the government. The rural zones are managed by the state agents through rural councils. Trees Outside Forest are located in the national property (except classified areas), in public property and in private property.

2.3. TREE OUTSIDE FOREST CLASSIFICATION

Tree Outside Forest can be classified according to the following criteria : (i) Field disposition; (ii) Principal function; and (iii) type of ecosystem. (DIOUF and al, 1999)

2.3.1. Field disposition

a) Isolated trees are naturally regenerated or planted within houses, fields, gardens, etc., generally for fruit production (*Adansonia digitata*, *Tamarindus indica*, *citrus sp.*), (AFRENA, 1990) leaves production (*Borassus aethiopicum*, *Adansonia digitata*, *Moringa oleifera*, *Cordyla pinnata*), wood production (*Eucalyptus sp.*, *Azadirachta indica*, *Khaya senegalensis*, *Cordyla pinnata*, etc...), shade (*Azadirachta indica*, *Adansonia digitata*, *Khaya senegalensis*) and for cultural purposes (*Adansonia digitata*, *Celtis integrifolia*, etc) (Seyler, J. R. 1993)

b) Scattered trees on farm lands or pasture lands

The most frequent land use system where trees are associated with crops and/or animals is known as parkland. In this ecosystem, trees are mainly selected and protected for fruit, wood and leave production, for soil fertility improvement, etc ... The most known parklands in the Sahelian countries are : (i) *Faidherbia albida* (Senegal, Mali, Burkina and Niger); (ii) *Adansonia digitata* (Senegal, Mali Burkina Faso); (iii) *Butyrospermum paradoxum* (Mali, Burkina and Eastern part of Senegal); and (iv) *Borassus sp* (, Mali, Burkina Faso, Niger and Senegal).

b) Linear plantations comprise: living fence, windbreak, plantation along roads, etc....

➤ **Living fence** is generally used to protect crops, vegetable, fruit trees against free grazing. *Euphorbia balsamifera*, *Euphorbia tericuli*, *Jatropha curcas* are traditionally used in this technology. Living fence is largely used in many african countries. Since 1985 Agroforestry research is testing many multipurpose thorny species to replace the traditional ones to improve the technology. Among them *Acacia laeta*, *Acacia mellifera*, *Acacia tortilis*, *Acacia nilotica*, *Zizyphus mauritiana* and *Bauhinia rufescens* are more useful.

➤ **Wind break technology** is not traditionally known in the sahelian countries. Forestry development services and National Research Institutes are implementing the technology in many land use systems. *Eucalyptus sp.*, *Prosopis sp.*, *Racosperma holosericia* are generally used in the rice irrigated systems of Senegal, Niger and Mali. In the Senegalese peanut basin, the association of fast growing trees (*Acacia tortilis*, *Acacia nilotica* with thorny shrubs (*Acacia mellifera*) is currently used as windbreak and living fence. This technology, locally called fence-windbreak, is being generalized in the peanut basin.

➤ **Trees along roads**

During the colonial period, many trees have been planted in many african countries along national and departmental roads. *Khaya senegalensis* was mostly used. After the independence *Azadirachta indica* was largely propagated in the sahelian countries. This exotic species, very adapted to drought, is becoming proliferating even in the natural forests. Its elimination is a serious problem in some areas. (Fred Weber, M. W., Hoskin, 1983).

d) Trees planted in houses

are generally planted for shade (*Khaya senegalensis*, *Azadirachta indica*), for fruit (*Mangifera indica*, *Citrus sp*, *Carica papaya*) for leaves (*Moringa oleifera*, *Adansonia digitata*, etc...).

e) Trees planted in homegardens are generally used for fruit production to improve and diversify household revenues. *Mangifera indica*, *Citrus sp*, *Carica papaya*, *Musa sp* etc... are generally planted in depressions where water table is not so deep and along the Senegal river (in Senegal, Mali and Mauritania) and Niger river (in Mali and Niger). Improved *Mangifera* and *Citrus species* are now largely propagated in these areas. In Senegal, Mali, Niger, Ivory Cost, Guinea, etc., fruit commercialization is contributing significantly to national macro-economy increase (Shea, k. R. and Ned, D. Bayley. 1982).

2.3.2: Principal functions

Tree Outside Forest may be classified according their function (economic, ecological, socio cultural, scientific and medicinal and recreation).

a) Economic function

The economic function, mostly preferred (Ndour and Gaye, 1996), encompasses :

- **Wood production** (firewood, poles, matches, etc). *Eucalyptus sp.*, *Azadirachta indica*, *Borassus aethiopum*, *Cordyla pinnata*) are the main species of that category.
- **Fodder production** (*Faidherbia albida*, *Pterocarpus erinaceus*, *Pterocarpus lucens*, *Celtis integrifolia*, *Leucaena leucocephala*, *Bauhinia rufescens*, etc...).
- **Fruit production** (*Mangifera indica*, *Cordyla pinnata*, *Parkia biglobosa*, *Adansonia digitata*, *Detarium senegalensis*, *Elaeis guineensis*, *Detarium microcarpum*, *Zizyphus mauritiana*, *Borassus aethiopum*, *Butyrospermum paradoxum*, etc ...)
- **Gum production** (*Acacia senegal*, *Acacia laeta*, *Sterculia setigera*, *Acacia seyal*, etc...)
(Badji, S., Ndiaye, I., Danthu, P. et Colonna, JP. 1991)
- **Oil and wine production** (*Elaeis guineensis*, *Borassus aethiopum*, *Balanites aegyptiaca*);
- **Leave production** (*Borassus aethiopum*, *Adansonia digitata*, *Moringa oleifera*).

b) Ecological function is becoming more and more important in the Sahelian countries where the climate is relatively harsh. Those trees contribute to soil fertility improvement (Jung, G. 1967; Louppe, D. 1989; Louppe et al. 1996), watershed protection, shelter and shade for domestic and wild animals, salinity alleviation (SADIO, S. 1991:

c) Socio-cultural Function

In Africa Trees outside Forest play important socio-cultural roles through sacred forests, taboo trees, totem trees, etc.... The sacred forests are protected and managed for traditional religion practices, cult and sanctuary. Biodiversity in these ecosystems is generally rich and diversified since all wood exploitation is forbidden for any purpose.

Adansonia digitata, *Tamarindus indica*, *Celtis integrifolia*, *Bauhinia rufescens*, *Borassus aethiopum* are the most well known taboo and totem trees in West Africans particularity in Senegal. Under those venerated trees sacrifices and prayers are regularly and periodically done for God grace.

d) Scientific and medicinal function

In many African Universities, botanic gardens with many tree species are managed for scientific and medicinal purpose.

e) Recreation function

In many African cities, public places are managed for resting and recreation. Ornamental trees are mostly used for that purpose. Among them, *Cordia sp.*, *Hibiscus sp.*, *Cactus* species, etc... are mainly planted and managed by communal councils.

2.3.3. Ecosystem type is the simplest classification criterion. It indicates the zone where TOF are located. Trees in the field and trees outside field are the principal categories.

a) Tree within field comprises parklands, delimitation plantation, living fence, windbreak annual and pluriannual fallows, contour plantation, vegetation strips, alley cropping trees, etc...

b) Tree outside field encompasses homegardens, trees in inhabited areas, trees in public places, trees planted along roads, in village woodlots, in individual plantations, etc...

2.4 . TREE OUTSIDE FOREST TENURE

In many African countries, land (natural resource support) is inherited by matriarchal or patriarchal ways, according to the customary law. For government law land and natural resources belong to the state. In so doing, TOF conservation and sustainability are a real problem. In fact, in many African countries, gathering fruit and wood from TOF is totally free whenever the resource is not protected. This not well defined property right is a source of many conflicts between land owners and forest protect gatherers. To mitigate this problem, the new Senegalese forestry law tends to responsabilise more and more land owners to manage themselves trees in their lands in order to benefit from the usufruct. For planted trees, property right has no ambiguity, nevertheless, tree owners should always have an authorization from the local forest agents before cutting and/or selling a single tree. For common properties, wood and fruit gathering are controlled by communities.

2.5. CONSTRAINTS TO TREE OUTSIDE FOREST SUSTAINABILITY

Tree Outside Forest survival faces many difficulties in most western African countries due to population growth, overgrazing, low and irregular rainfall, inadequate agricultural practices, inadequate land tenure policies, etc.

2.5.1. Population growth

The high population growth rate in West Africa (3,2% per year in Senegal) increases regularly population needs for food, fuel and habitat. To satisfy those needs, many hectares of forest and other natural reserves are disappearing at an alarming rate (1,2% per year) (Tybirk and al, 1990). In the urban areas in Senegal, many natural reserves are disappeared for inhabitation needs.

2.5.2. Inadequate agricultural practices

Traditional farmers use to integrate in the same land trees with crops, and/or animals to sustain production. During the green revolution, focused on peanut and cotton production increase, farmers were advised by the agricultural development service to cut and uproot all trees in farmed land to facilitate mechanization. This so-called modern agriculture degraded tremendously soil and vegetation cover in many countries. With the decrease of rainfall, many species disappeared by lack of natural regenerate.

2.5.3. Rainfall decrease

The long drought of the last thirty (30) years contributed significantly to the mortality of many species in the sahel. In fact, in the sahelian part of many west african countries, many sudanian species have completely disappeared because of low and irregular rainfall.

2.5.4. Overgrazing and bush fire

In the sahelian countries, the lack of grass during the dry season du generally to bush fire, causes the pruning and lopping of some outside forest species (*Faidherbia albida*, *Pterocarpus erinaceus*, *Adansonia digitata*, *Celtis integrifolia* etc.). This inadequate practice decrease significantly the productivity of injured trees and increases tree death rate.

2.5.5. Inadequate land use policies

According to the domanial law, in Senegal, many non valuated land for four (4) years may be attributed to any landless who makes the demand. In addition, all borrowed land for more than four years may be taken up by the borrower. These confusing dispositions make land owners very careful to put land in fallow or lend it to landless, for more than four years. Knowing that, after four years, borrowed land returns to the owner, borrowers are not always motivated to protect, regenerate and manage conveniently trees in farmed lands.

III – INSTITUTIONAL EXPERIENCES

After many years of conventional forestry approach (forestry management in classify forests, industrial plantations with fast growing species such as *Eucalyptus camaldulensis*, *Azadirachta indica*, etc.), that failed to take into account population needs and local knowledge, many government forest services are adopting a new approach (button - up) one that involve actively farmers in tree planting, conservation and management. The most significant activities on Tree Outside Forest undertaken by the senegalese forestry development service and the forestry research center are described below.

3.1. TREE OUTSIDE FOREST DEVELOPMENT PROJECTS

Since the 80th, most of the forestry development projects were focused, in Senegal, on rural/social forestry and agroforestry. The following table shows the different projects implemented in Senegal from 1980 to 2000, the covered geographic zones and the related main objectives.

Table 1: The main forestry development projects on Tree Outside Forest conducted in Senegal from 1980 to 2000

Project title	Localization	General objective	Duration	Funding agency
(1) Village	- Podor	- Regeneration of dying trees;	1984-	Netherlands

reforestation: Acacia nilotica forest restoration (PROGONA)	- Matam	- Village woodlots creation;	1993	Senegal
(2) Natural ecosystem restoration (PREMINA)	- Saint louis - Richard Toll - Podor	- Forest product development through windbreak and woodlots; - Environment conservation;	1988- 1995	EDF Senegal
(3) Sylvo pastoral management and reforestation (Zone Nord)	- Sylvo- pastoral zone - Linguere - Podor - Dagana	- Water reserve rehabilitation around 6 drillings; - degraded farm land regeneration;	1975- 1994	Rep of Germany
(4) Community reforestation in the peanut basin(PRECOBA)	- Fatick - Thies - Koalack	- Salty soils revalorization; - Sylvo – pastoral management; - Promote agroforestry technologies; - Community and individual plantation;	1982 - 1995	USAID Senegal Scotland
(5) <i>Amacadium</i> project (PASA)	- Fatick - Kaolack	- Population revenues increase; - Agricultural technologies improvement;	1979 - 1984	Rep. Germany Senegal
(6) Diourbel Agroforestry Project (PAD)	- Diourbel	- Soil degradation process; - Population welfare improvement	1990- 2001	IFAD Senegal
(7) Borassus parkland regeneration (- Thies - Mbour	- Inventory, protection and management natural ressource; Assisted regeneration	1989- 1992	BID Senegal
(8) Village reforestation (PROBOVIL)	- Louga - Bakel - Mbacke	- Village reforestation; - Natural regeneration assistance	1982- 1994	Sweden Senegal
(9) Senegal Reforestation Project (PRS)	- National	- Promote rural reforestation Encourage private enterprise for plantation along road	1988- 1994	USAID Senegal
(10) Integrated program for conservation and natural resource management (PICOGERNA)	- Tamba - Counda - Kaffrine - Bakel	- Responsabilise rural population in natural resources management	1990- 1992	CCCE FAC BM Norway
Project title	Localization	General objective	Duration	Funding agency
(11) Littoral conservation (CTL sud), (CTL nord), (FDK)	- Saint Louis - Louga - Dakar - Thies - Tivaouane	-Vegetable gardening preservation - promote population participation	1975- 1994	Canada PNUD BNE PAM – UNSO Netherlands
(12) Forestry rural	- National	Elaboration of strategic forestry	1988-	PNUD

development (PDRF)		approach in Senegal	1994	Senegal Netherlands
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Among the 24 forestry projects conducted in Senegal from 1980 to 2000, 12 were mainly focused on Tree Outside Forest improvement and sustainability. Those projects were implemented from the north to the south. Most of them involved actively local people in their activities by using participatory approach. Some of them are successful and others have mixed results.

3.2. TREE OUTSIDE FOREST RESEARCH ACTIVITIES

Since 1978, the National Senegalese Forestry Research Center (CNRF) started introducing fast growing trees (*Eucalyptus sp* and *Acacia sp*) in farmed land, in the south peanut basin. In 1986, a well structured agroforestry research project funded by France through its Cooperation Aid Fund (FAC), focusing on tree reintroduction on farms plots was implemented in the peanut basin land use system. Many other agroforestry research projects funded by ICRAF, IFAD (International Found for Agriculture Development), USAID, EDF (European Development Fund) etc... followed. Their main objectives were to develop, on station and on farm plots, agroforestry technologies to sustain production and alleviate poverty in rural areas. The following table shows the main Tree Outside Forest research project conducted in Senegal these fifteen last years.

Table 2 : Agroforestry research projects conducted in Senegal the fifteen last years

Project title	Funding agencies	Period	Covered region	Tested agroforestry technologies
Tree role in agricultural exploitation	cooperation and Aid Fund	1986 - 1990	-North peanut basin - South peanut basin, - Casamance	Living fence, parkland, soil conservation
Diourbel Agroforestry project accompanying research	IFAD	1990 – 1997	Diourbel region	Parkland, windbreak, living fence, fodder bank
SALWA project	IFAD IRDC, (through ICRAF)	1989 – 1997	- Diourbel region - Kaolack region	Parkland, windbreak, living fence, fodder bank, alley cropping
Project title	Funding agencies	Period	Covered region	Tested agroforestry technologies
Fallow project	European Development Fund (EDF)	1994 – 2000	Kaolack region, Kolda region, Casamance	Parkland Fallow, living fence, biodiversity
Natural Resource Based on Agricultural Research	USAID	1993 – 1998	All Senegalese regions excepts Saint	Parkland, windbreak,

(NRBAR)			Louis and Louga	living fence, fodder bank, alley cropping
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IV – REGIONAL INITIATIVE: SALWA case study

4.1. INTRODUCTION

The creation of the Semi Arid Low land of West Africa in 1989 was subjected to two phenomena :

- The desire of the International Center for Research in Agroforestry to improve the population welfare of african developing countries by the integration of perennial trees in the agricultural production systems and other land use systems to increase yield, diversify product and assure systems sustainability and ;
- the fact that hand, National Agricultural Research Institutes (NARS) of west african countries wish to collaborate with ICRAF and the governments of Burkina Faso, Mali, Niger and Senegal signed cooperation agreement to develop agroforestry technologies and reinforce national capacities for agroforestry research ;

The main SALWA objectives are :

- promote appropriate agroforestry technologies for the sahelian countries with the collaboration of National, Regional and International Institutes working in the area;
- reinforce national agroforestry research system capacities ;
- conduct strategic research in agroforestry.

4.2. NETWORK ORGANIZATION

SALWA has structure at national and regional level.

4.2.1. National level

In each country member, it was created a National Directory Committee of Agroforestry Research (NDCAR) having the following attributes :

- advise countries in defining policies and priorities related to rural development through agroforestry ;
- evaluate agroforestry projects and programs ;
- assure the linkage of all national organizations involved in agroforestry development and research and
- approve the national documents to be submitted in the regional evaluation and planification meetings.

4.2.2. Regional level

With the following structures :

- Regional evaluation and planification meeting ;
- Regional director committee and ;
- Regional coordination.

4.3. COVERED ECOLOGICAL ZONE

The target ecological SALWA zone goes from Senegal to Niger through Mali and Burkina Faso on 700.000 hm² . Sixty (60) to 85% of the rural population are found in this area where the essential food from crops are produced (map 1). In each country, the principal land use system was chosen (Central plateau system in Burkina, Parkland system in Mali, Valley system in Niger and South and North peanut basin in Senegal).

4.4. TREE OUTSIDE FOREST RESEARCH MADE IN SALWA NETWORK

During his eight (8) year existence , SALWA was focused on five (5) agroforestry technologies (Parkland, Windbreak, Living fence, soil and water conservation, fodder bank). In 1995, the prioritization of the most preferred TOF was done in Burkina, Mali and Senegal.

4.4.1. Parklands studies

Two types of studies are done for this agroforestry technology (Parkland inventory in Burkina, Mali and Senegal and Parkland production improvement)

a) Parkland inventory:

This documentary study was done in 1995 in each country by a forest consultant hired by ICRAF. The following tables show the main parklands per country, their localization the food and cash crop associated, etc....

Table 3 : The main agroforestry parklands in Senegal (SALL, 1996)

Parkland type	Localization	Accompanying species	Roles	Associated crops
<i>F. albida</i>	Peanut basin	<i>Guiera senegalensis</i> , <i>Balanites aegyptiaca</i> , <i>Adansonia digitata</i>	Fertilization fodder firewood	millet Peanut sorghum
<i>Acacia senegal</i>	Silvo - pastoral zone	<i>Balanites aegyptiaca</i> , <i>Combretum aculeatum</i> , <i>Acacia raddiana</i>	Economic firewood dead fence	Millet bean watermelon
<i>Adansonia digitata</i>	Center West Tamba Counda region	<i>Acacia ataxacantha</i> , <i>Combretum aculeatum</i> , <i>Tamarindus indica</i>	Food Fodder medicine	millet Peanut sorghum
<i>Borassus aethiopum</i>	Thies region Fatick Tambacounda region Casamance	<i>Pterocarpus erinaceus</i> , <i>Prosopis africana</i> , <i>Cassia sieberiana</i> <i>Combretum glutinosum</i> <i>Combretum micranthum</i>	Poles Food Craft industry	Millet sorghum peanut
<i>Cordyla pinnata</i>	Kaolack region Tamba Counda region Kolda region	<i>Combretum sp</i> <i>Pterocarpus erinaceus</i> <i>Prosopis africana</i>	Food Wood	Millet Peanut Maize sorghum
<i>Elaeis guineensis</i>	Casamance region Kolda region	<i>Combretum sp</i>	Food	Rice

Table 4 : The main agroforestry parklands in Burkina Faso (OUEDRAOGO, 1995)

Parkland type	Localization	Accompanying species	Roles	Associated crops
<i>Butyrospermum paradoxum</i>	Sudanian zone	<i>Parkia biglobosa</i> , <i>Faidherbia albida</i> , <i>Azadirachta indica</i> , <i>Lannea microcarpum</i>	Economic Food Medicine	Millet Sorghum
<i>Acacia raddiana</i>	Sahelian zone	<i>Faidherbia. albida</i> , <i>Hyphaene thebaica</i> , <i>Combretum glutinosum</i> , <i>Acacia senegal</i>	Fodder Firewood	Millet Sorghum
<i>Parkia biglobosa</i>	Western zone	<i>Butyrospermum paradoxum</i>	Economic Food	Millet Sorghum
<i>Faidherbia. albida</i>	Eastern zone	<i>Tectona grandis</i> , <i>Parkia biglobosa</i> , <i>Butyrospermum paradoxum</i>	Fertilization Fodder	Millet Sorghum

Table 5 : The main agroforestry parklands in Mali (CISSE, 1995)

Parkland type	Localization	Accompanying species	Roles	Associated crops
<i>F. albida</i>	Secondary dry valley, recent ergs, high sandy lands	<i>Borassus aethiopum</i> , <i>Sclerocarya birrea</i> , <i>Hyphaene thebaica</i>	Fertilization Fodder	Millet sorghum maize cotton
<i>Parkia biglobosa</i>	high sandy lands	<i>Sclerocarya birrea</i> , <i>Lannea microcarpum</i>	Economic Food Firewood	Millet sorghum
<i>Butyrospermum paradoxum</i>	Northern center zone, Western zone	<i>Parkia biglobosa</i> , <i>Sclerocarya birrea</i>	Economic Food Firewood	Millet sorghum
<i>Hyphaene thebaica</i>	Coarse sandy lands	<i>Sclerocarya birrea</i>	Craft industry Economic Food	Millet sorghum maize

a) **Parkland production improvement** focused on Multi Purpose Use Trees planting within parklands, Natural regeneration assistance, etc... to increase production.

4.4.2. Windbreaks

This technology was experimented in two countries (Niger, in the Valley system, and Senegal, in Bambey station). The target species were (*Eucalyptus sp*, *Racosperma holosericea*, *Prosopis sp*, etc...). In these experimented way, the technology was not successful.

4.4.3. Living fence

Live fencing is the most investigated technology in the hole countries. *Zizyphus mauritiana*, *Acacia laeta*, *Acacia mellifera*, *Acacia nilotica*, *Acacia tortilis* and *Bauhinia rufescens* are tested to protect cassava, vegetables, fruit trees, annual crops, in some extend, etc.... The technology was successful in the four countries where it is largely propagating now.

4.4.4. Fodder bank was tested in Mali and Senegal with *Pterocarpus érinaceus*, *Pterocarpus lucens*, *Bauhinia rufescens*, *Gliricidia sepium*, (for the first country.), *Bauhinia rufescens*, *Gliricidia sepium* *Zizyphus mauritiana*, *Leucaena leucocephala*, *Hardwickia biinnata*, *Caesalpinia ferrea* and *Moringa oleifera* (for the second). *Pterocarpus lucens* and *Gliricidia sepium* are more performant in Mali while *Zizyphus mauritiana*, *Bauhinia rufescens* and *Gliricidia* did best in Senegal. This technology is been transferred in farm plots.

4.4.5. Alley cropping was only tested in Niore, Senegal with *Gliricidia sepium*, *Leucaena leucocephala*, *Azadirachta indica*, *Hardwickia binnata*, etc... After four (4) years of experimentation, the evaluation showed that the technology did very bad because of low rainfall and low biomasse productivity. (NDOUR and al, 1997). It was therefore recommended to take it off from the technology package.

4.4.6. Soil and water conservation

This technology was only tested in Burkina Faso with : *Bauhinia rufescens*, *Zizyphus mauritiana*, *Acacia nilotica*, associated with *Vetivera negrita*, *Andropogone gayanus*, etc. It was very successful and is propagating in the Burkina rural area.

4.4.7. Prioritization of the most preferred Tree Outside Forest species

This study was done in Burkina Faso, Mali and Senegal in 1995. Its main objective was to identify the ten (10) most preferred species in each country and the five (5) ones in the whole region for the elaboration of a tree improvement research program. The following table shows the obtained results.

Table 6: The ten most proffered Outside Forest Species in Burkina, Mali and Senegal

RANK	BURKINA FASO	MALI	SENEGAL
1	<i>Butyrospermum paradoxum</i>	<i>Butyrospermum paradoxum</i>	<i>Adansonia digitata</i>
2	<i>Parkia biglobosa</i>	<i>Adansonia digitata</i>	<i>Cordyla pinnata</i>
3	<i>Lannea microcarpa</i>	<i>Parkia biglobosa</i>	<i>Faidherbia albida</i>
4	<i>Tamarindus indica</i>	<i>Tamarindus indica</i>	<i>Tamarindus indica</i>
5	<i>Adansonia digitata</i>	<i>Lannea microcarpa</i>	<i>Balanites aegyptiaca</i>
6	<i>Bombax costatum</i>	<i>Faidherbia albida</i>	<i>Zizyphus mauritiana</i>
7	<i>Faidherbia albida</i>	<i>Sclerocarya birrea</i>	<i>Parkia biglobosa</i>
8	<i>Balanites aegyptiaca</i>	<i>Khaya senegalensis</i>	<i>Detarium microcarpum</i>
9	<i>Zizyphus mauritiana</i>	<i>Cordyla pinnata</i>	<i>Ficus icteophylla</i>
10	<i>Diospyros mespiliformis</i>	<i>Borassus aethiopum</i>	<i>Azadirachta indica</i>

This study shows that *Adansonia Digitata* is the most preferred species in the sub – region. It is followed by *Butyrospermum paradoxum*, *Parkia biglobosa*, *Tamarindus indica*, *Faidherbia albida*, etc... On the base of this result, one can conclude that Trees Outside Forest are mostly protected and managed in the parklands for food production (NDOUR and GAYE, 1997).

V – CONCLUSION AND RECOMMENDATIONS

Trees Outside Forest are facing many difficulties, in Africa, and particularly in Sahelian countries due to low and irregular rainfall, inadequate agricultural practices, inadequate natural management policies (land and tree tenure), etc...

Many countries investigated to mitigate those problems and sustain productivity. Most of the related activities were very successful by using participatory approaches and working with networks. To sustain these efforts, some recommendations are done :

- better sensibilise local people to protect Trees Outside Forest to combat desertification, assure food security and mitigate poverty ;
- adopt natural resource management policies to the present ecological, economic and socio-cultural conditions;
- implement agricultural practices which conserve biodiversity and
- disseminate performant natural resource management technologies through publication, international meetings, networks, etc....

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EXPERT CONSULTATION ON TREES OUTSIDE FORESTS

“ENHANCING THE CONTRIBUTION OF TREES OUTSIDE FORESTS TO SUSTAINABLE LIVELIHOODS”
(FAO/HQ, Rome, 26-28 November 2001)

Policy, inventory and management of trees outside forests in a densely populated country: A case study of the UK

By

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Summary

The UK is one of the more affluent, urbanised and densely populated countries in the World. As such it has little remaining forest and livelihoods derived from timber or other forest products are insignificant. However, trees in the countryside (farmlands) and urban areas are highly regarded in terms of landscape, ecological and biodiversity value. This paper explores the consequence of this in terms of policy, inventory and management planning. There are lessons of relevance to the inventory of TOF which can be drawn from the recently completed national inventory of Small Woodlands and Trees in the Countryside. Perhaps the most useful finding is that the number of plots enumerated needs to be carefully considered to ensure that errors are acceptable across the wide range of feature sizes represented by TOF (small woods, linear features, groups and individual trees). UK policy is mixed with some powers being vested in the Forestry Authority and others with the Countryside agencies. The main emphasis in management is the maintenance and replacement of trees as amenity and conservation features rather than as sources of income or products. Harvesting of TOF is hampered by problems of scale and a lack of wood-using rural enterprises. There are initiatives designed to stimulate farm forestry and related enterprises but it is probably too early to judge how they are performing.

Introduction

Farming, forestry and rural life in the UK¹ is currently undergoing an unprecedented change in forest, agriculture and rural development policy. This is a consequence of great changes in farming and forestry resulting from falling farm and forest incomes and public pressure to protect the UK's unique anthropogenic rural landscapes for amenity and recreation. Decentralisation has acted to facilitate change as it has resulted in the promulgation of three new forestry strategies for England, Scotland and Wales, which for the first time, permitted a wide and public debate on the role of trees, woods and forests in the unique landscapes and economies of the three countries. Likewise, the creation of a new Department for Environment, Food and Rural Affairs (DEFRA)² earlier this year has afforded an opportunity to re-define policies for sustainable development³ for the UK.

This paper examines how these changes will affect trees outside forests (TOF) and their role in the maintenance and enhancement of rural landscapes and livelihoods though it is acknowledged that urban TOF are very important.

Background

The United Kingdom is an affluent country with one of the highest population densities in Europe (average of 2.4 people per ha) with a total population of just under 60 million people.

¹ The UK is made up of England, Scotland and Wales on the island known as Great Britain (GB) and Northern Ireland which is a part of the neighbouring island of Ireland.

² Formerly the Ministry of Agriculture, Food and Fisheries.

³ DEFRA's aims and objectives were released on the 14th November 2001. It's aim is:

Sustainable development, which means a better quality of life for everyone, now and for generations to come, including:

- A better environment at home and internationally, and sustainable use of natural resources;
- economic prosperity through sustainable farming, fishing, food, water and other industries that meet consumers' requirements;
- thriving economies and communities in rural areas and a countryside for all to enjoy.

Needless to say this goes hand in hand with extreme deforestation with only around 2% of the land remaining under ancient woodland⁴ cover. Overall levels of forest cover reached an all time low during the First World War and this led to the establishment of the Forestry Commission (FC) in 1919 which was charged with the task of planting forests. By 2000, forest cover in the UK had risen to 11% with the planting of large scale plantations of exotic conifers. More recently there has been a shift. After the large scale afforestation of the uplands in the early 20th century there has been a significant shift towards the management and establishment of small scale woods within agricultural landscapes and on the promotion of public participation in woodland-based activities.

The UK countryside is a palimpsest of anthropogenic landscapes dating back to the Bronze Age (~ 1000 BC). The field patterns created largely in Anglo-Saxon times (~1000 AD) were marked by boundaries of hedges and walls as a consequence of the Enclosures Acts passed by Parliament between 1750-1950. The resultant landscape was an intimate mix of small scale woods and fields marked with hedgerows⁵ and punctuated with large isolated trees. These hedgerows and associated trees were managed as production systems for poles (as pollards and coppice), fruit, timber and a range of other products. They also help to prevent soil erosion and water run-off, shelter and control livestock and protect crops from wind. However, during the mid 20th century wholesale mechanisation of agriculture and urban sprawl made large changes to the familiar landscape of the countryside. This was viewed with dismay by a large part of the UK population, both urban and rural, who hold the countryside in high esteem as an integral part of their cultural and aesthetic heritage.

It is this background that forms UK TOF attitudes, policy and activities. It is interesting to note that this is being driven by aesthetics and conservation more than production or the environmental functions of trees. This is probably a natural consequence of the TOF agenda being driven by a wealthy and essentially urban society who have long since ceased to consider rural TOF as a source of products or livelihoods.

Inventory of trees outside forests

The 1919 Forestry Act gives the Forestry Commission a statutory responsibility to collect statistics on the country's stock of woodland and trees. The first inventory of TOF was in 1951 and TOF have been incorporated in national forest inventories ever since⁶ (inventories were done in 1965 and 1979-82). The fourth national inventory of TOF was completed in 2000 and the first report for England has just been published (Forestry Commission 2001). The sources for the protocols for the Small woods and trees inventory are: Wright 1998, Jordan and Wright 1997, Smith & Gilbert *pers comm*.

The inventory of Small woods and trees collected data on four classes of TOF feature with a tree being defined as more than 2 m tall. The features identified are:

- small woods - woods of between 0.1 and 2 ha⁷ in area and canopy coverage greater than 20% (unless felled or recently planted),
- groups of trees - areas of less than 0.1 ha but more than 1 tree including young trees spaced less than 5 m apart,

⁴ 'Woodland' and 'woods' are terms often used in the UK synonymously to 'forest' to describe areas of land carrying trees in the UK. The term is used as a diminutive in the same manner as a hill is less than a mountain.

⁵ A hedgerow is a boundary formed from woody shrubs which is maintained as a barrier of around 1.5m height. Standard (full sized) trees are often incorporated at intervals in the hedge.

⁶ This is a rare example of recurrent inventory for TOF in Europe. The only other countries to formally inventory TOF are France and the Netherlands (although this has been discontinued).

⁷ Woods greater than 2 ha are included in the main woodland survey (=forest inventory).

- individual trees - crowns should have no contact with any other trees, further divided into:
 - ✓ boundary trees - an individual tree on a boundary⁸
 - ✓ middle trees - an individual tree not on a boundary
- linear features⁹ - not less than 25 m long and four times as long as they are broad. Further divided into:
 - ✓ wide linear features greater than 16 m wide (treated as small wood in field survey)
 - ✓ narrow linear features less than 16 m wide (treated as group in field survey).

Given these definitions, it is clear that TOF in the UK could be described as trees covering an area of less than 2 ha and more than 2 m tall. The Small woods and trees inventory did not consider urban trees which are found in profusion as avenues along roads, in parks and private gardens. It was considered that these trees are the responsibility of the urban councils which had often undertaken their own surveys of street trees. However, urban trees were included in the 1951 TOF inventory.

The inventory used a stratified systematic 1% sample of 1x1 km grid squares across the whole land area of the UK. The stratification was at two levels, the coast and counties (administrative units) were sampled separately. The total sample size was 2,347 squares (km²) for GB.

Tree and land use features were mapped for each sample square from 1:25,000 scale aerial photography. Areas of more than 2 ha were counted as 'countryside' within developed (built up) areas and areas of more than 2 ha of buildings were counted as developed land and trees within them were not sampled. Trees within developed land of more than 2 ha were not included in the survey. The extent of small woods and the lines of linear features are mapped and measured. Groups and individual trees are only recorded in the field. The 1 km square was subdivided into 16 250x250 m squares and two of these were chosen at random for field survey.

In the two 250x250 squares the following attributes are recorded in the field:

- Individual trees - species, alive or dead, height¹⁰ (in 5 classes), number of stems and a health code were recorded.
- Groups - species, height, number of dead and living trees and average health was recorded.
- Small woods - management practices, crop data, timber potential, mammal damage, percent dead wood and natural regeneration were recorded.
- Linear features - width, species, height, number of live and dead trees and average health are recorded.

Within stands of more than 0.05 ha a 0.01 ha circular plot was laid out in a subjectively chosen 'representative' part of the stand at the rate of one plot per 0.5 ha to a maximum of four. To compensate for sparse stands, the plot size was increased to 0.02 ha if less than 5 trees were recorded in the 0.01 ha plot. In each plot, the species and diameter of each tree and top height (height of the largest diameter tree) of the stand is recorded.

The gross results of the survey for England are given in Table 1. Broadleaves are much more common than conifers with the commonest species being; Ash (*Fraxinus excelsior*), Oak (*Quercus spp.*), Willow (*Salix spp.*) and Sycamore (*Acer pseudoplatanus*).

⁸ Includes trees standing in a hedgerow.

⁹ Hedgerows were not included unless the plants within it were large enough to be considered trees in which case it was recorded as a linear feature.

¹⁰ The trees were considered to be 'unproductive' and mainly of interest as landscape features so only height was recorded.

Table 1: Occurrence of TOF features in England

Feature type	Number of features	Mean area (ha)	Area (ha)	Length (km)	Numbers of trees		Dead (%)
					Alive	Dead	
Small woods	131 900	0.47	62 300	-	-	-	-
Wide linear features	34 800	0.37	12 800	4 800	-	-	-
Narrow linear features	1 172 800	-	-	91 200	60 509 100	1 056 100	1.7
Groups	3 299 200	-	-	-	22 431 100	366 900	1.6
Individual boundary trees	-	-	-	-	4 489 700	91 200	1.9
Individual middle trees	-	-	-	-	1 787 000	45 600	2.5

Because of differences in design it is not possible to directly compare the results of this inventory with the previous one in 1980. However, it does give an indication of the type of changes that have occurred (Table 2). What is clear is a large reduction in the number of groups and individual trees. The pattern of changes is consistent with the mortality figures given in Table 1 and suggests that the trees are dying or being removed and not replaced. Middle trees are the most susceptible as they impede tractor cultivation and are therefore often removed, even if tolerated they experience repeated root damage, suffer high mortality and seldom replanted. The increase in linear features is probably not unrelated to the groundswell of public opinion against their removal and the institution of grant incentives to restore them (see below).

Table 2: Comparison between 1980 and 1998¹¹ inventories of TOF for England (000s trees)

Feature type	1980	1998	Change (%)
Boundary tree	6 010	3 868	-34
Middle tree	8 331	1 165	-85
Groups	23 461	12 998	-45
Linear features	24 601	31 351	27

The intention is for TOF inventory to become continuous so that a smaller sample of fixed plots if measured every year over a five year cycle and planning for this is underway. The main lesson that has been learnt from the 1998 inventory was that insufficient data was collected on groups and individual trees as they were only sampled from a sample of 0.125% of the UK land area (one eighth of the 1% sample of 1 km² grid squares). Given the low density of groups and isolated trees this meant that there were very few trees recorded in the survey. It is proposed to address this by doubling the sampling fraction for groups and individual trees (making it 0.5%).

Monitoring landscape change - the Countryside Survey

The term 'countryside' is used to denote all areas which are not built up as such it encompasses a range of land uses from agriculture, parks, forests, wildlands and villages. Over the past century the nature of agriculture and consequently the appearance of the countryside has changed dramatically. Many of these changes are perceived as damaging and there is concern to monitor the rates of change and intervene to protect the intrinsic qualities of beloved landscapes. The Countryside Survey was established more than 20 years ago with previous surveys in 1978, 1984 and 1990 with the most recent assessment completed in 1999 and reported in 2000 (CS2000, Haines-Young *et al* 2000). The CS2000 survey was financed by the Department of Environment, Transport and the Regions¹² with a wide range of partners representing the statutory conservation agencies and regional government and was undertaken by the Centre for Ecology and Hydrology¹³.

¹¹ Differences in figures from Table 1 result from the harmonisation of categories between the two inventories.

¹² Now part of DEFRA

¹³ The former Institute of Terrestrial Ecology and Institute of Hydrology.

The Survey is based around recording the existence, extent and health of 18 broad habitats recognised by the UK Biodiversity Action Plan. Field sampling is based on a stratified random sample of 1 km² grid squares. The strata are the ITE Land Classes which themselves result from an ordination analysis of landscape features and represent the major environmental and anthropogenic gradients present in GB. Altogether 569 sample squares were visited, 366 in England and Wales and 203 in Scotland. Ninety percent of the squares had been previously visited in 1980 and formed the basis for an evaluation of landscape change over the intervening 20 years. Within each grid square a stratified random sample of small vegetation plots are measured with the strata being major landscape elements such as field boundaries, streambanks, road verges etc.. Soil and freshwater habitats are also sampled to track pollution and water quality. A large scale satellite image interpretation to generate land cover maps and a public computer-based Countryside Information System are other important outputs of the survey.

The CS2000 reports on the changing stock and condition of a broad habitat described as 'Boundaries and Linear Features'. This habitat is relevant to TOF as it includes hedges, hedgerow trees and lines of trees whether part of a hedge or not. Table 3 gives a summary of the results for these features for GB. The results show no significant change in the total stock of hedges between 1980 and 1998 but the length of remnant hedge decreased by 21% (mostly due to continued degradation to relict status) while the length of lines of trees and shrubs (153,000km) had increased by 31%.

Table 3: Stock and change in linear landscape features in GB from CS2000

Linear feature	England and Wales		Scotland	
	1998 stock (000s km)	% change from 1990	1998 stock (000s km)	% change from 1990
Hedge	449.3	0.0	19.0	4.6
Remnant hedge	52.3	-20.9	5.3	-20.0
Wall	105.8	-2.5	87.1	-1.7
Line of trees/shrubs and relict hedge and fence	70.0	30.8	11.1	14.0
Line of trees/shrubs and relict hedge	83.4	31.4	13.3	22.2
Bank/grass strip	70.0	-2.5	12.4	6.3
Fence	423.2	6.6	233.7	3.9

The condition of the hedges was recorded from two plots measuring 1x10 m in each square containing hedges. All vegetation including herbs growing along the bottom of the hedge were recorded. The data from remeasurement of these plots indicate that in the eastern lowlands of England that there has been a 12% decline in species richness due to less intensive management (perhaps due to falling farm incomes). Older hedges which are characterised by woodland vegetation had not changed.

In 1998, for the first time up to ten 30m sections of hedge the diversity of trees and shrubs were recorded. The density of woody species in a standard 30m length of hedge is used in the definition of species-rich hedgerows in the UK Biodiversity Action Plan and the Hedgerow Regulations. The results of this survey indicate that 26% of sampled hedges had five or more woody species and would therefore qualify as a species-rich hedge according to the UK biodiversity action plan definition.

Valuation of TOF

There are few rural enterprises which use the products of TOF. Studies in the 1980's clearly showed that few TOF are converted into timber because of the high cost of transport, low quality of the logs (embedded metal which can damage saws) and a lack of small-scale local wood-using enterprises. NWFP i.e. fruit, nuts etc. collection ceased at least a generation ago. The main use for TOF is as a source of firewood for local, usually rural, households which does not generate a significant income and as a decorative hardwood (burr elm for small-scale crafts).

However, this does not mean that TOF do not have a value. IERM & SAC (2001) were commissioned by the former MAFF to conduct a valuation of field margins and hedgerows. Using a contingent valuation they report a willingness to pay of between £14-26 per household per year to protect against further losses of hedgerows and £11-14 for a 5% increase. The values for hedgerows was. The ability to generate such figures is required for appraising agri-environmental policy which have hedgerows maintenance targets.

It is perhaps easier to value urban trees and the National Urban Forestry Unit presents figures which suggest that trees can save up to 10% of energy consumption in nearby buildings through their moderation of local climate and can increase property values by up to 18%.

Changing attitudes to agriculture and forestry: changing policy

TOF do not exist in isolation but are part of a wider landscape which is perceived through a social filter which often has little to do with agriculture or livelihoods and much to do with the aspirations and concerns of a largely urban populace. It is most often perceived as a whole, as a better place to live than towns and under threat (Countryside Agency 2001). Public concern for the countryside and awareness of rural issues has increased markedly over the past decade with many concerns being shared by rural and urban people.

Over the past decade there have been a number of developments which have served to shift the rural agenda in the UK. Among these are:

- loss of farm incomes: there has been > 80% fall in UK farm incomes over the past few years so that average farm incomes are now around £8,000 per year which counts as poverty in the UK. This fall is largely blamed on globalisation, large scale retailing and the effects of disease (BSE, FMD etc) on livestock prices,
- uncompetativeness of UK timber in the face of global competition (from eastern Europe),
- conflict between rural and urban sensibilities with regard to fox hunting,
- increased concern with erosion of traditional rural landscapes,
- erosion of rural services as communities shrink (schools, post offices, police, public transport being withdrawn etc.),
- conflict over access to rural housing by local people (houses in some areas are prohibitively expensive for rural poor because prices are driven up by urban demand for second homes),
- conflict between recreational access to farmland,
- a perception that urban-based government is out of touch and unconcerned with rural issues.

At the same time devolution and Ministry re-organisation together with a commitment to public consultation conspired to facilitate the formulation of new policies for agriculture and forestry at the same time. This has provided an unprecedented opportunity for change in policy and

hopefully action to integrate ideas on rural, urban and sustainable development. This is summed up in the recent Rural White Paper (DEFRA 2001) for England which offers a utopian vision of a living, protected countryside with thriving prosperous rural communities.

However, there is much work required to genuinely integrate forestry and rural agendas. The extent of the divide is evident from the observation that both the environment and forestry agencies undertook assessments of TOF in 1998-9 and it is not even possible to directly compare the results of the two sets of data. It is to be hoped that a greater degree of integration can be achieved in the future.

Policy and incentives for TOF management

Over the past year, three new forestry strategies have been developed for England, Scotland and Wales. There is little mention of TOF in the policies and few direct interventions planned though there is general support for initiatives lead by DEFRA and the countryside and conservation agencies. In brief this is what the three strategies have to say about TOF.

England

'ensure that policies promote not only substantial woodlands but also rejuvenated hedgerows, parklands, orchards, copses, shelter belts and urban trees'.

However, no targeted actions towards this are identified in the strategy but this is addressed in complementary rural development and conservation strategies.

Scotland

Priority for action	Increase diversity of the farmed landscape
Why?	<ul style="list-style-type: none"> ▪ Because the loss of traditional woodland cover e.g. shelterbelts and hedgerows has created an open landscape devoid of the benefit of woodland structure ▪ Because this represents an opportunity to integrate forestry and farming, helping to ensure that complementary land use can enhance overall environmental value.
Benefits	<p>Improving the attractiveness of the landscape; opportunities for game, small-scale timber (and wood fuel) production, providing an alternative use for agricultural land</p> <p>Riparian woodlands for pollution mitigation, protect river systems and improve river habitat quality</p> <p>Establishing connections between existing woodlands</p> <p>Absorbing development and screening new buildings</p> <p>Re-creating where appropriate, historic landscapes for their cultural value</p>
Costs	Depends on scale of activity, incentives of more than £2000 per ha may be needed for new planting, with grant support for project such as restoration of shelterbelts
Partners	<p>Rural Affairs Department (Farm Woodland Premium Scheme, Rural Stewardship Scheme)</p> <p>Scottish Natural Heritage (identification of priority areas and grant support)</p> <p>Local Authorities (identification of local priorities in Indicative Forestry Strategies)</p> <p>Forestry Commission (targeted grant support and technical advice)</p> <p>Private sector (farmer, growers and agents - by taking advantage of grant support and advice to provide land and undertake the work)</p>

Wales

Strategic objective 2.4.3 To provide support for farm woodlands and the wider rural economy
Activities

- work closely with the farming sector to establish a farm woodland subject group
- encourage farmers to diversify their agricultural businesses through Farming Connect (business development grants), providing information on woodland management, contracting, and development of small scale wood processing

- help farmers make best use of farm woodland resources for livestock shelter and for timber products for on-farm use, better integrating the woodlands into the farming businesses and into the landscape
- help Coed Cymru (NGO) to continue to deliver support to farmers.

These different perspectives reflect the realities of the three countries and emphasises the importance of finding markets for the produce of small woods to support rural livelihoods (Wales), recreation and environmental functions (Scotland) and in landscape maintenance (England). All of these strategies are very new and many of the activities have yet to begin but it represents a major change in attitude and appreciation of trees.

Regulations to protect TOF

The principal instrument within the town and country planning system to protect trees and woods is the Tree Preservation Order (TPO). The purpose of a TPO is to prevent the felling or mutilation of the tree or trees covered by the TPO and to make provision for replanting them, if such an action is considered necessary. The TPO can prohibit the felling, lopping or destruction of the trees unless a planning consent has been obtained. They can also require the replanting of a woodland area, the felling of which has been permitted, subject to any specified conditions. TPOs are often only sought when a tree comes under threat and are instigated by local people.

Designated Conservation Areas are used by local planning authorities to protect the special character of areas under building development. All trees greater than 7.5 cm d are automatically protected in such areas.

In 1997 new legislation, the Hedgerows Regulations were passed. These regulations require that consent from the local planning authority is required before removal of hedgerows, if it is judged to be important according to certain criteria (historic, archaeological, landscape, biodiversity etc). The planning authority may prohibit the removal of such hedges by issuing a Hedgerow Retention Notice. The criteria include historic, archaeological, biodiversity, landscape or amenity value. The Countryside Survey 2000 revealed that around 26% of hedgerows would qualify for protection under the biodiversity criteria alone.

Agri-environment schemes, forestry grants and rural development initiatives

Under the Common Agricultural Policy operated by the EU, there is a provision to make available payments under agri-environmental schemes. There are three such schemes in operation: the Rural Stewardship Scheme (Scotland), Countryside Stewardship Scheme (England) and Tir Gofal (Wales). Entry into the scheme is voluntary and is conditional on the farm meeting certain environmental requirements i.e. it must contain features worthy of support from public funds. Entrants to the scheme agree to manage the farm according to an agreed management plan to cover things such as hedgerow management, stocking levels, pesticide usage, application of fertilisers etc.. In return the farmer receives annual payments for the environmental, landscape and biodiversity benefits created. The Tir Gofal scheme in Wales expects to enroll 600 farms (from more than 1300 applicants) into its first round of agreements at an annual cost of £5.5 million.

A further development of the realisation that it is better to target whole farms than individual field margins is the Countryside Agency's Landscape Character Initiative. Working from the premise that a landscape is more than just biodiversity, landscape or history it is seeking to understand how local character is formed from the unique juxtaposition of town, country and coast, of land form and landscape, of history and progress that create the many facets of England's character. Contrasts in local character make each location unique and lend it a 'sense

of place'. The Initiative seeks to extend landscape principles to the whole of the UK rather than just specific designated areas. This programme is in an early stage and so far has mapped the country into 159 separate, distinctive character areas. It is intended that the maps and associated narratives will form the basis for planning of stewardship schemes and other countryside management initiatives.

The Forestry Commission operates a grant-based incentive scheme to promote the planting and management of private woods. There are two grants available; the Woodland Grant Scheme (WGS) and the Farm Woodland Premium Scheme (FWPS). Both of these are targeted at the creation of woods within agricultural landscapes. The WGS has £17-18 million and the FWPS £4 million to disperse annually.

The WGS makes a payment of £1,350 per ha for native species plantings of less than 10 ha, eighty percent of the grant is paid in the first year with remainder five years later. The minimum area for grants is 0.8 ha. In England and Wales the majority of WGS plantings are very small. The aim of the WGS are to create new woodland to increase the production of timber, provide new habitats for wildlife and recreation, promote good management of woodlands, provide jobs and to provide a use for land other than agriculture.

The FWPS is more specifically targeted at the creation of woods on farms with the intention these can become a productive asset on the farm. Under the scheme annual payments of £140-300 per ha are made to compensate the farmer for agricultural income forgone on the planted land.

Alongside schemes which target husbandry of the landscape there programmes which seek to increase the opportunities for alternative rural jobs. Grants (such as the Rural Enterprise Scheme operated by the Countryside Agency for England) are available under these programmes to support the diversification of farm enterprises and the development of new rural businesses. Much of this is targeted at local processing and value addition and there is nothing specific that mentions the potential of TOF though there is also nothing to preclude funding of projects based on TOF. Indeed, most of the initiatives for small-scale local wood using enterprises would probably utilise TOF at least as a source of burrs and other decorative hardwood timbers.

Community forests

Since 1991 a consortium of partners including the Forestry Commission, Countryside Agency, NGOs and local authorities have operated a scheme designed to stimulate the creation and management of community forests. There are 12 of these forests all in urban fringe areas covering 452,649 ha within 20 km of 26.4 million people. The aim of these forests are to regenerate derelict land, green the urban fringe, provide for conservation and recreation and to establish a supply of timber and other woodland products and associated jobs. Since the 'forests' are actually to be created from plantings on private, public, agricultural and developed land they are not intended to become unbroken expanses of trees but rather a mosaic of woods and other land uses in which trees are treasured and managed. This then represents the overlap between urban and rural TOF. Since 1991 the scheme has been responsible for the planting of over 7,419 ha of new woodland, bringing 24,000 ha of existing woodland and 170 km of hedgerow into management and reclaimed 1,638 ha of brownfield. The scheme has also been successful in obtaining £7 million in sponsorship, donations etc. and £18 million from the National Lottery.

Since the mid-1980's there has emerged a new type of public-private-NGO forestry partnerships. The 12 community forests mentioned above are just a few of the 98 regional forestry initiatives emerging from local authorities, Forestry Commission, NGOs and communities themselves. They are regional in that they focus on maintaining, enhancing and establishment of woods and trees across landscape bigger than a single farm. They are partnerships as they include many privately owned farms as well as public land. At first the

emphasis was on amenity but increasingly they are seen as opportunities for jobs and the creation of small forest product-using enterprises. Most initiatives are multi-institutional and are business-like as they employ a few people to administer business plans to secure funding from government grants, industry sponsorship, EU and National Lottery etc. and co-ordinate activities. Examples of such initiatives are Anglia Woodlink, Cumbria Broadleaves, Marches Woodland Initiative, Wessex Coppice and Yorwoods.

Perhaps the most ambitious community forest is the 200 square miles of National Forest being established by the National Forest Company which is a public body created by the former Countryside Commission. The Company is using innovative partnerships with local authorities, farmers, landowners, companies, local communities and people from all over the country to create a new forest on what will largely be private land. The forest itself will be designed to provide a landscape for amenity, public enjoyment, education, nature conservation and economy of the area. In the Company's own words a 'blend of ancient woodlands and new plantings to frame a glorious and varied mosaic of farms, open country, towns and villages'.

NGO initiatives

There are a whole range of community and NGO-facilitated forestry projects in the UK many of which relate to TOF both in terms of management and exploitation. There are many examples of community councils, individuals, schools etc. initiating local action on behalf of individual trees, woods, forests or landscapes. Pre-eminent among these is Reafforesting Scotland which started out with the idea of restoring the Scots Pine forests of the highlands of Scotland. Many such groups have taken up the dream of planting forests for the future and have been able to secure funds from the National Lottery to create a Millennium Forest. There are increasing numbers of locally led forestry initiatives notably the emergence of Crofter Forestry in which estate tenants are given management rights and ownership of land they occupy. This is supported by the new Scottish Forestry Strategy which adds its voice to the calls for tenural reform in Scotland to facilitate the transfer of land rights from feudal estates to communities usually under co-operative arrangements. However, this is more like small scale forestry than TOF.

Here are some examples of NGOs which have specific TOF initiatives (in no particular order) to give an indication of the level of public involvement with TOF.

National Urban Forestry Unit - established in 1995 to raise awareness of the positive contribution that trees make to the quality of life in towns. They note that even in towns, trees yield traditional products such as timber and fruit, while emerging commercial products such as wood chip mulch, renewable fuel and extractives (taxol from yew) are helping to finance urban tree and woodland management. They run a range of projects:

- Trees of time and place - sponsored by Esso with the intention that everyone would grow at least 1 tree from seed during their lifetime
- Woods on your doorstep
- Woodlands for the Millennium

Tree Council - works to promote trees. It runs several campaigns many with industry sponsorship.

- The National Grid Tree Warden scheme is design to co-ordinate volunteers to play an active role in conserving and enhancing their local trees and woods. The Wardens are appointed by parish councils or other community organisations. Since 1990, Tree Warden Networks have been set up throughout the UK with over 7,000 voluntary Tree Wardens.
- Family tree scheme - requests that people make a donation to plant a tree in the name of a relative or to commemorate an family event in a permanent planting on 23 sites mostly in community forests.

- Trees for schools - encourages the planting of trees around schools
- Trees love care - education and advice in the care of young trees
- Seed gathering Sunday - a designated day for mass collection of tree seed for local planting

Woodland Trust - largest and most politically active NGO. It provides advice and grants to woodland owners and campaigners. Campaigns on woodland issues including hedgerows and other TOF. Owns and manages native woodlands.

Coed Cymru - Welsh NGO that provides management and marketing advice to farmers with small woods. The woods they manage are entered into a FSC group certification scheme.

Common Ground - NGO interested in promoting the use of Commons. Has a programme to save and create orchards.

Small Woods Association - Provides technical advice. More interested than most in incoming generating initiatives associated with small woods. These are a selection of small projects from the SWA register.

- Clun Valley alder charcoal pilot project - management and charcoal production from overgrown riverside alder coppice
- Local woodland products initiative - promote the use of poles (hazel coppice) as bean poles and peasticks to local gardeners to finance the creation of more shrubby habitat in urban areas.
- Kentish Cobnuts Association - promotes the propagation and marketing of cobnuts
- Tree register of the British Isles - list of remarkable trees

Greenwood Trust - established in 1984 to promote the use of green, small diameter wood in traditional crafts.

British Charcoal and Coppice Group - endeavours to promote coppice management and the marketing of produce from small woods principally as charcoal.

Protecting and maintaining hedgerows

A case study of how these different instruments have been applied to hedgerows in the UK demonstrates how an undesirable situation can be turned around.

In 1945 there was an estimated 500,000 miles of hedgerows but in the period 1947-1969 the mechanisation and intensification of agriculture led to hedgerow clearance at the rate of 2,600 miles per year with clearance reaching its peak between 1984-1990 at 5,378 miles per year. This combined with neglect and dereliction brought about a radical change in arable landscapes particularly in England. The adverse impact of this on amenity and biodiversity values led to increasing calls for public intervention in the processes of landscape change.

In 1984 the Countryside Survey revealed that 23% of hedgerows had by then been lost. This confirmed the magnitude of the problem and served to raise the profile of hedgerows as a conservation and heritage issue. By the late 1980's grants to destroy hedgerows for farm intensification were withdrawn and in 1992 replaced with the Hedgerow Incentive Scheme (England) and Hedgerow Restoration Scheme (Wales). These schemes grant aided the replacement and restoration of priority hedges (ancient, important wildlife habitat, on degraded landscapes or of particular amenity value). The grants were to cover initial restoration followed an agreed 10 year management programme. Since 1996 these grants have been incorporated into stewardship schemes. In 1997 the Hedgerow Regulations came into force bringing a 'stick' to join the 'carrot' of grants.

In 1999 the Government introduced its strategy for sustainable development (DETR 1999). The contribution of hedgerows and other field boundaries to the quality of the rural landscape and biodiversity was recognised in the strategy and one of the Quality of Life Counts indicators was targeted at hedgerows. The indicator sets three targets for hedgerows, by 2005:

- to halt loss of hedgerows,
- to bring 50% under favourable management and
- to maintain overall numbers of hedgerow trees.

The data to assess the Quality of Life Counts indicator for hedgerows is derived from the Countryside Survey (as in Table 3). Comparison of the 1998 with 1990 survey permits an investigation of the types of changes which are taking place and provides a measure of the success or otherwise of hedgerow management. What emerges is that the net loss of hedges reported in 1990 has been halted by a seven-fold decrease in hedge removal, that planting rates have remained constant and degradation through neglect has been to some extent mitigated by restoration. These findings are generally supported by the FC inventory which found a significant increase in linear groupings of trees.

It would appear from CS2000 that the incentives and awareness raising have been successful in halting the loss of hedgerows as there has barely been time for the Regulations to have had a measurable effect. The remaining problem of hedgerow neglect and dereliction (the shift of hedges to relict hedges and loss of species diversity) is being targeted by the stewardship schemes and the next task is to bring more of the hedgerows back into active management and good heath.

Concluding comments

Generally the TOF scene in the UK is dynamic perhaps because of, rather than despite, the high degree of urbanisation. There is an apparently large willingness to pay for quality countryside. It could be argued that these values are being directly translated into livelihoods through annual payments for environmentally sensitive management through stewardship and farm woodland premium schemes from public money. Public money is also being used to facilitate and support the creation of community forests which seek to make forests more accessible to city dwellers thus avoiding conflict with farming.

The lead on TOF issues is coming from the agriculture/conservation sectors rather than forestry. Forestry responsibility stops at the 0.8 ha cut off for the WGS grants. Features below this size are inventoried and reported by the FC but they have no responsibilities or programmes directed at their management. The development of regulations and incentives for TOF are lead by DEFRA which represents the agriculture and rural development sectors.

Although NGOs are able to access public funds through the grant schemes many seek to raise funds and generate income through the sale of TOF products such as charcoal, extracts, flowers, fruit, nuts and poles etc.. Much of the processing of such products is done using traditional craft skills and small scale 'green' enterprises. There is a growing appreciation that to be sustainable and contribute to the sustainability of rural life there is a need to market and use the products of farm woods and trees. There are a number of initiatives in this area, both of a practical nature and research sponsored by the EU and countryside agencies.

Consideration of developments in TOF reveals some interesting dynamics; there has been a shift from targeting interventions at features (hedgerow incentives) to farms (stewardship schemes) and onwards to larger scales as demonstrated by the Countryside Character Initiative. There has also been an emphasis on incentives and civil concerns acting like peer pressure rather than

regulation. In this context, TOF ceases to be about trees and much more about integrated, multi-purpose management of land.

This is a case study of the UK but these developments are echoed across Europe as demonstrated in the ILO review of public participation in forestry in Europe (FAO/ECE/ILO). It is encouraging to think that even in affluent, urbanised countries with intensive high tech farming practices that there is still a role for TOF in rural landscapes and life and it provides an entry point for urban people to enjoy and be involved with nature.

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The material presented in this paper was drawn from the following sources.

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English Nature	www.english-nature.gov.uk
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Forestry Commission	www.forestry.gov.uk
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Scottish Natural Heritage	www.snh.gov.uk

NGOs

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DRAFT

Social and Economic Factors Influencing Trees Outside Forest Development: *The Costa Rican Case*¹.

Olman Segura-B².

Abstract

Central American countries changed from forested areas to agriculture land and pasture in the last half century. The predominant vision of development and economic growth in the fifties was linked with agro-export production, which supported the expansion of agriculture and cattle ranching. Forest was perceived as an obstacle for development and growth; therefore incentives for land use changes were created by governments and encouraged by international agencies and donors.

Nowadays, forest cover is recognized not only as key natural resource which provides basic environmental services to humanity, but also as source for raw material for economic activities. We may say that there has been a forest value evolution. This kind of change, in countries such as El Salvador or Costa Rica, --which was once one of the most deforested countries in the world— were the forest cover for production purposes is very reduced, make a counter effect increasing the value of trees outside forest (TOFs).

There are no specific policies favoring them; however, the countries with clearer policies on forest activities and forest services, seem to have greater appreciation for them. The most common TOF in the region are constituted by trees on agricultural and pasture land and some in urban and peri-urban areas. Farmers who have trees within their agriculture plantations, in the farm fences and pastures, appreciate them not only because the additional services they provide, but also because they constitute a saving and a financial resource to use in any future emergency. In this sense, farmers livelihood is also changing from considering forest as an obstacle, towards a more integrated forest resource concept which provides goods, services and financial resources when needed.

TOF are becoming a very important source of raw material for industries. Legally or illegally cut, these trees are currently providing an important part of the total wood supply to primary transformation industries. Therefore, TOF produce benefits, providing jobs, raw material for the industry and dynamic to the sector; but in the other side, it affects the formal forestry sector if the resource is illegally cut, introducing unloyal trade practices affecting market prices and the transparency of the sector in general.

After reviewing the current role of TOF, the paper emphasizes that it is very relevant to enhance research and create innovative policies. The knowledge economy is also entering the TOF resources. Their values are evolving and it is important to sustain and to promote the institutional change that is happening.

¹ Paper submitted to the Expert Meeting on Trees Outside the Forest. 26-28 November, 2001. Rome, Italy.

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1. Introduction

Goods and services from forest and trees outside the forest (TOF) are very important for people's livelihoods and economic activities (TOF definition in section 5). In spite that this is a fact all around the world, it is not until recently that we may find some examples of economic internalization of such benefits. In general, forests and trees are valued for the timber they produced and not valued for the rest of services they provide to society. Why is this situation like that? What is the kind of information we need in order to really include all TOF values into everyday economics and decision making?

Forest values in Central America are slowly changing and Costa Rica is in the forefront. These countries are in the process of recognizing, through market mechanisms and other instruments, several forest services. A new economic instrument called Environmental Payment Services (Pago de Servicios Ambientales, PSA) was created by law in Costa Rica, recognizing those services for forest and forest plantations. However, the law does not include TOF for this payment. In this sense, TOF are harvested with no consideration and somehow weak resource management, since they are not competing with alternative activities such agriculture and cattle. Therefore, another question we should to try to address in this paper is: how to increase the market value for TOF?.

We focus on the Costa Rican case, just as an example, trying to unveil the process and reviewing the applicability of such innovative mechanisms for TOF management in there and other countries. After all, forest as well as TOF seem to produce the same kind of services to people. The second section explains the Costa Rican evolution in the forest cover, which shift from being a deforesting country in 1950s to a well recognized conservation and reforestation country nowadays. In the third it is included a description of the forest value evolution towards a higher value of forest. The fourth section deals with the theoretical explanation of the "learning economy" and economics of knowledge which may lead us into innovations for TOF. The fifth section evaluates the applicability of the Costa Rican example and the innovation theory to TOF, including a short list of potential business opportunities from TOF and finally some conclusions and recommendations are presented in the last section.

2. The forest value evolution in Costa Rica

Relatively to its size, Costa Rica was once one of the most deforesting countries in the world. Today it is a pioneer in policies to support forest use and forest services. In the same way that many other countries in Latin America, land use change is highly sensitive to both, forest internal and external policies. This was especially true in Costa Rica, where land use change has reflected support for agricultural and cattle policies during long time in the past (1950s to 1990s). However, during the last decade this situation has been changing.

According to the IMN/MINAE/UNEP³ study, it is possible to state that, as shown in table 1, between 1979 and 1992 there was a change of 20.8% of the country's land, equivalent to

³ IMN/MINAE, PNUMA; MAG; IGN, DGF. 1996. Evaluación del cambio de Cobertura de la Tierra en Costa Rica 1979-1992. San José, Costa Rica.

1,064,327 hectares⁴. Out of this total, 322,515 ha (6.3%) were transformed from natural forests into pastures. The conversion of secondary forests amounted to 458,225 ha, or 9% of the land area; however this was not considered deforestation as the land had been used for pastures or crops. Total deforestation of natural and secondary forest during that period was 780,740 ha, or 15.29% of the total area, equivalent to a deforestation rate of 1.18% per year.

Table 1. Land Use Changes in Costa Rica (1979-1992)

<i>From</i>	<i>To</i>	<i>Area Change (ha)</i>	<i>% of Area Change</i>
Natural forests	Pastures	322,515	6.3
Secondary forest	Pastures	401,828	7.9
Secondary forests	Seasonal crops	13,324	0.3
Secondary forests	Permanent crops	43,073	0.8
Permanent crops	Pastures	30,516	0.6
Permanent crops	Secondary forests	14,158	0.3
Seasonal crops	Pastures	22,892	0.4
Pastures	Permanent crops	61,696	1.2
Pastures	Seasonal crops	33,420	0.7
Pastures	Secondary forests	105,490	2.1
Seasonal crops	Secondary forests	12,415	0.2
No change		4,041,989	79.2
Total		5,103,316	100.0

Source: IMN/MINAE/UNEP. 1996.

The most recent study, titled "Survey of Forest Cover in Costa Rica, 1986/87–1996/97" identifies changes that occurred during that decade by evaluating deforestation, natural regeneration, and reforestation. Using NASA's Pathfinder methodology for tropical deforestation, the study proposed four categories of forests: primary forests, intervening forests, secondary forests, and forest plantations whose density and crown cover could be determined by the method.⁵ According to the study, out of the 1,608,459 ha of forest studied,⁶ 164,245 ha were deforested and converted to other uses, and 126,873 ha were secondary forests and forest plantations recovered. These changes, observed in table 2, resulted in a deforestation rate of approximately 16,400 ha/year and a net loss of 3,737 ha/year during the period of the study.

Table 2. Net Change in Forest Area (1987–1997)

<i>Parameters</i>	<i>Area (ha)</i>	<i>% of Total Area</i>
Total area covered by the study	1,608,459	31.49
Deforestation	164,245	3.22
Recovery	126,873	2.48
Net loss	37,372	0.74

Source: Survey of Forest Cover in Costa Rica. CCT-CIEDES, 1998.

The same document CCT/CIEDES as may be seen in table 3, showed that forests covered in Costa Rica was 40.5% of the total land in 1996/97. And the final balance reflects an annual

⁴ Among other titles, this section is based in my coauthor document De Camino, R., Segura, O., Arias, L and Pérez, I. (1999).

⁵ Primary forests are untouched by humans. Intervening forests have been harvested at least once for timber production. Secondary forests result from the natural regeneration of abandoned pastures or farmland. Forest plantations are forests that result from planned reforestation of land that was occupied by pastures or crops.

⁶ The analysis of the change in forested area is partial (only 1,608,459 ha), the caducifolius forest of Guanacaste (126,884 ha) was excluded because it was impossible to compare, and 13% of the country showed only clouds and shadows when the image was taken.

deforestation rate of 16,400 ha/year, and an annual reforestation rate of 22,282 ha/year, with a net positive annual balance of 5,857 ha/year.

Table 3. Forest Cover in Costa Rica (1996/97)

<i>Cover Type</i>	<i>Area (ha)</i>	<i>% of the Total Area</i>
Natural nondeciduous forests	1,885,782	36.92
Deciduous forests	126,884	2.48
Mangroves	40,848	0.80
Highlands	9,973	0.20
Total	2,063,487	40.40

Source: CCT/CIEDES/FONAFIFO. 1998.

In this sense, as stated above, Costa Rica's forested areas are increasing annually. This is largely because of reforestation and the regeneration of secondary forests in abandoned pastures. It is very clear that the increased area of plantations and secondary forests has less environmental value than natural forests, and they are not substitutes, however, it is possible to say that a significant change has been happening along these years.

However, the area of privately owned forests that are used for wood production has been greatly reduced. According to the National System of Conservation Areas (*Sistema Nacional de Areas Conservación*, SINAC), there were about 250,000 ha of privately owned production forests in 1997, and out of this amount, only 50,000 ha were virgin forests.

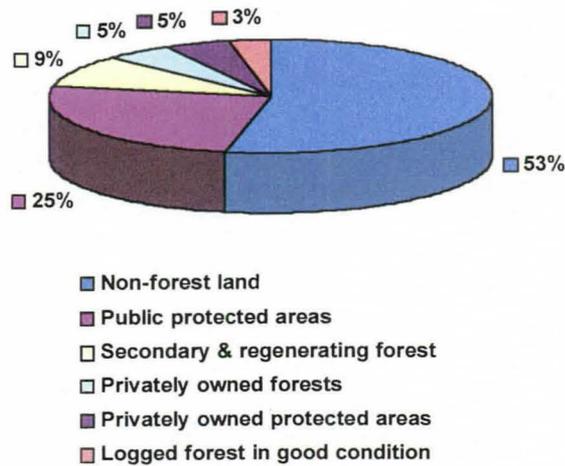
The protected area system of Costa Rica has also been an important factor in reversing deforestation and is a practical approach to protecting biodiversity. The system is composed today by a mixture of public and private reserves, of more than 120 protected areas, totaling over 1.2 million ha in 1998⁷ and encompassing about 24.8% of the land.

Figure 1 shows that there are 1,287,000 ha of public protected areas, close to 25% of the land; 44,026 ha of private reserves belonging to the Costa Rican Network of Private Reserves (CNPR), for approximately 5% of the territory, and 205,974 ha of other kinds of natural forests that may be protected through private ownership. Private sector participation grew rapidly between 1980 and 1999, and it is very much due to eco-tourism activities very well developed lately in the country.

In short, there has been a significant change in the land use cover in Costa Rica in the last 40 to 50 years. Agriculture and pasture lands are partially converting to secondary forest, forest for production purposes is being reduced significantly and protected areas increased even in private hands. Why is this happening? It is discussed in the following section.

⁷. Mena, Y.; Artavia, G. 1998. Parques Nacionales y otras áreas Silvestres Protegidas de Costa Rica. SINAC/MINAE. There are also higher figures, but in any case the positive trend is the same.

Figure 1. Forest Land in Costa Rica



Source: Solorzano et al., 1991; MIDEPLAN, 1995d; MINAE-SINAC, 1996a; IMN, 1995; Davies, 1997; Alpizar et al., 1997.

3. The Evolution Towards Higher Value of Forest

Forests, and especially forest plantations, benefited when incentives for agriculture and cattle ranching diminished and meat prices fell. But also, reforestation started in the country when specific incentives were introduced. First there was profits tax exemptions for those reforesting; second these were transformed into Forest Certificates (Certificados de Abono Forestal, CAF) which were granted to those who reforest and use them also to pay all kind of taxes. Third, these certificates were paid in advance (CAFA), precisely in order for those people who did not pay taxes and did not have any resources to start the forest plantation, to receive the necessary resources to start with such activity. With the creation of this kind of incentive a larger democratization was introduced in the system. Later there was created a Forest Development Fund (FDF), a revolving fund which lent money to farmers with less than 25 hectares to reforest. The resources for this fund were donated by the Dutch Government and complemented the CAFA for small farmers. Other kind of subsidies were also created for Municipalities and small farmers. All these kind of incentives together, yielded reforestation of more than 147,000 ha in approximately 20 years.

One important piece of information so far, is that the potential of plantations as a resource (147,810 ha planted) could probably produce at least 1.5 million cubic meters of raw material for the industry, sequester about 500,000 tons of carbon annually, and maintain a stock of 10 million of tons of carbon over a 20-year rotation.⁸ This means that forest plantations are standing not only because it needs to grow more, but because there is an important quantity of resources being accumulated.

Forest management was also introduced and incentivated. Several technical assistance projects, such as the German Agency of Technical Cooperation (GTZ), the United States

⁸. This calculation assumes a growth of 10 cubic meters/ha/year, a wood density of 0.45 grams/cubic meter, a 1.6 ratio of stem volume to total biomass, and a coefficient of 0.46 tons of wood/tons of carbon.

Agency for International Development (USAID), the Agency for International Development (DFID) of the United Kingdom, the Agronomical Tropical Center for Research and Education (CATIE), tried to improve forest management in the country, especially in the North Region. Improvements included the following:

- Simplified guidelines yielded better management plans.
- Timber inventories, harvest planning, harvesting and logging technologies, and design of logging roads all improved.
- Forest owners and government authorities provided better control of harvesting and timber transport.
- Post-harvest silvicultural interventions (timber production and forest improvements, such as first-time planting) were introduced. These included vine cutting and thinning for the selection of better tree species.
- Forest farmers formed large associations, which provided technical assistance and simplified the paperwork needed to apply for incentives.

Until 1993, forest sector incentives were oriented solely toward plantations. After these improvements, however, the government began to provide financial support for natural forest management through Certificates of Payment for Natural Forest Management (*Certificado de Abono Forestal para Manejo*, CAFMA), instituted in 1994. Like CAF and CAFA, CAFMA is a title of nominative value in national currency, which may be traded or used to pay national or municipal taxes or tariffs. CAFMAs supported the preparation of forest management plans and the implementation of silvicultural treatments.

All these kind of incentives created along time evolved into Payment of Environmental Services (Pago de Servicios Ambientales, PSA). The law created in 1996⁹ this instrument, which has the objective of financing forest management, reforestation, natural regeneration, forestry nurseries and recovery of damaged areas. FONAFIFO (National Fund for Financing Forestry) manage the resources transfers between groups of the private sector who pay and who receive the payment. FONAFIFO is operationally independent of the government and has legal identity; however, the board of directors has three members appointed by different governmental offices, namely the Ministry of Agriculture (MAG), Ministry of Environment and Energy (MINAE) and the Central Bank (BCCR), plus two private sector representatives. FONAFIFO pays forest owners for forest environmental services (PSA) with the funds from carbon sequestration plus funds from fossil fuel taxes¹⁰, plus resources that they may receive from hydroelectric plants that pay for the water cycle maintenance and other resources coming from forest services payments. The four legally established forest services are, carbon sequestration, water cycle maintenance, biodiversity conservation and natural scenic beauty.

According to De Camino, et al (1999), PSAs were introduced in Costa Rica for five reasons. First, according to the Structural Adjustment Program, distortions introduced through subsidies such as CAFs, CAFMAs, and CPBs should be eliminated. Second, the goal of PSAs is not simply to lighten the burden on the public budget, but also to incorporate the “polluter pays” principle to shift the burden to the beneficiaries of environmental services. Subsidies

⁹ However, the National Congress is currently discussing a possible name change to National Fund for Environmental Services (Fondo Nacional de Servicios Ambientales, FONASA), and among other things, the possibility of transferring it to the civil society, since it is financing most of the PSA.

¹⁰ Costa Ricans also pay for the emission of carbon into the atmosphere at the national level, through a tax of 5% on the hydrocarbons. One third of the amount collected is allocated by law to FONAFIFO for carbon sequestration in trees.

were a necessary incentive for reforestation activities since the revenues from traditional forest products, especially wood, were largely insufficient to make these activities competitive with other types of land use. These subsidies reached \$100 million between 1979 and 1996.

Third, subsidies had at least two negative consequences for the forest sector. They perpetuated the image of a poor sector and a deficit-plagued branch of the economy dependent on uncertain and irregular state subsidies. They also encouraged a fixation on a single product, typically wood, valued in monetary terms, with a tendency to neglect other forest services. Subsidies also created dependency on the government, PSA do not do it.

Fourth, the analyses show that private landowners must be paid for the environmental services they are providing to the national and international communities; otherwise, private landowners will mine the forests or convert their land to other uses. Finally, one goal of PSAs is to attach noticeably greater monetary value to environmental services, which so far, have been largely ignored. The payments should have a positive effect on forest management: when a forest owner receives payment for environmental services, he will give greater consideration to managing his forests and be less inclined to change to other land uses.

Now, why the Costa Rican case is so particular, what is behind this whole this change and what is behind the logic of PSA? Next section tries briefly to explain it.

4. What is behind these changes?: “the learning economy”

Positive environmental services from forest ecosystems are classified as externalities in economics. The challenge is to identify those externalities, value them and internalise them into the economic sphere. Some of these services or externalities are enjoyed by the forest owner, others are enjoyed by the national community and the rest by the international community. We need, therefore, to bring or to pull those values into the inflow of resources the private owner is receiving, in order him to really value them. In Costa Rica this process of internalisation is being done in four different services (see table 4) through the PSA.

Environmental services	Private ownership	National	Inter-national
Wood/timber	X		
Hydrological cycle		X	
Scenic beauty		X	
Carbon sequestration			X
Biodiversity conservation			X

The creation of PSA is considered an innovation for the forest sector in general and the Costa Rican in particular (Segura, O., 1999). This innovative instrument is taking advantage of the common knowledge that we have about forest services and the increasing environmental consciousness, in order to internalise those externalities. There is nothing new about the relationship between forest resources and the maintenance of the hydrological cycle or carbon sequestration, etc; but what is new is the *economically use* of these knowledge.

According to Lundvall (1992) Systems of Innovation “*are constituted by elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge.*” Systems of Innovation may be local, national or regional according to geographical areas; however, it seems very clear—even in globalization times—that National Systems of Innovation are very relevant since legislation, incentives, rules and other actions favouring or disesteeming policies are generally nationally drawn. In our forest case, the creation of PSA is obviously at the national level according to national legislation.

The performance of a national innovation system is influenced especially by specific parts of 1) the institutional set-up, 2) the knowledge infrastructure,¹¹ 3) the specialisation pattern, 4) the public and private demand structure (or consumer tastes in the broad sense), and 5) the government policy (Gregersen and Johnson 1997). Each of these parts have to take into account the environment and natural resources. In the Costa Rican case, each one of these five parts has its own characteristics which all together gave allowed the creation of such innovation. The law, including PSA creation, may be copied by other countries, but the characteristics of the parts of the national system of innovation and their interactions are actually the ones that stimulate or hamper the appropriate functioning of PSA.

Sometimes we do not use the existing knowledge, as in the case of environmental externalities. Some of the positive and negative impacts of production processes are well-known and there is well-developed knowledge of the benefits that we perceive from ecological services (for instance from water, forest, and others resources). However, we tend not to *use* this knowledge, or no to consider the effects which they produce in the system. According to the scholars who work with the SI framework, one important feature of good performance of the SI is not only to produce knowledge, or to have it (tacit or codified), but also to “use” it.

Knowledge and learning are very important for understanding systems of innovation. Furthermore, knowledge has been considered the most important resource and learning the most important process for the creation of innovations (Lundvall, 1995). National economies are moving towards this idea and from here emerges the concept of “learning economy.”

Institutions in the sense of patterns of behaviour and rules of the game (North, 1990 and Johnson, 1992), are common and central elements of the systems of innovation (SI). All definitions¹² of SI include in one way or another, institutions as a key element which influences innovations. Institutions are path dependent and are not characterised by a specific purpose. Individuals and groups share institutional set-ups reflecting how they understand the functioning of the world and how they perceive their relations to nature.

At this point, it is important to stress the distinction between organisations and institutions, since both are going to be analysed in this research. Although, ministries and other formal structures are called “institutions”, in common language here they will be known as “organisations”. Organisations are formal structures (players or actors) with an explicit purpose and they are consciously created (North, 1990; Edquist, 1997). They are also important elements in the innovation system, since they serve as vehicles for change and thus affect new policies and incentives. For this paper about trees outside forest (TOF), entities

¹¹ Knowledge infrastructure refers to formal education and research organisations, such as universities, technical programs schools of engineering, and research centres.

¹² For definitions of “institutions” in economic terms, see North (1990); Nelson and Sampat (1998); Ostrom (1990); Johnson (1992) in Lundvall (ed) (1992).

such as firms, ministries, governmental offices and non-governmental organisations (NGOs), all, are important organisations.

Therefore, the SI of each particular nation or region will be shaped and built according to their institutional framework. For instance, in Central America, the basic common understanding was that development and economic growth should be achieved by exporting agricultural products. Then, the institutional set-up, including both formal and informal rules of behaviour and interaction in the economy, supports the idea of development as linked to agriculture, cattle ranching, and other “basic” activities. It was therefore common to perceive the forest mainly as an obstacle to development; consequently, all the policies and the whole institutional set-up was built to promote the agricultural sector. Firms, research institutes, and other organisations interacted with governments in a common institutional set-up, reproducing more or less the same innovation system within the strongly established dominating framework. It is impossible to change the general performance of the national system of innovation (NSI) without changing the institutional framework in which it is operating. An explanation of how this approach about SI may be related to TOF follows in the next section.

5. Goods and Services From TOF

In general, it is necessary greater awareness about the benefits of maintaining and increasing TOF (definition in box 1). However, due that the System of Innovation (SI) is rooted in institutions, it is also necessary to realize fundamental institutional changes to truly value TOF. In the Central American case, if we consider that the forest sector as well as TOF may have possibilities of increasing competitiveness and of contributing to the economic performance of the region, then we need to encourage different ways of learning and innovation. Current consumer habits, as well as some of the organizations’ methods, practices, incentives and technologies may be included as elements where changes are needed. In other words, there is a need for continuous technological, organizational, policy and institutional learning to really take into account the social, ecological and economic TOF values.

Box 1 **Trees Outside the Forest (TOF)**

TOF includes trees on land that fulfils the requirements of forest and other wooded land except that the area is less than 0.5 hectares; trees able to reach a height of at least 5 meters at maturity in situ where the stocking level is below 20 percent; scattered trees in permanent meadows and pastures; permanent tree crops such as fruit-trees and coconuts; trees in parks and gardens, around buildings and in lines along streets, roads, railways, rivers, streams and canals; trees in shelterbelts of less than 20 meters width and 0.5 hectares area.

Source: FAO, 1998; Kleinn, 2000.

We may say that farmers as well as other people who are in urban or rural areas living around TOF areas, are somehow valuing them. However, the important point we must stress is that most of these TOF are disappearing with no substitution. People are losing not only the beautifulness but also the rest of goods and services that they provide.

TOF produce, not the same, but similar functions than forested areas. For instance, carbon sequestration, biodiversity conservation, soil protection, water cycle maintenance, wood, firewood, medicinal plants, contribution for the biological corridors formation, and others (Kleinn, 1999). However, some of these functions are TOF specific such as, shade on pastures, windbreak, living fences, ornamental areas, forage, and others, but also beautifulness, urban amenity, recreation, etc.

In Costa Rica there are not well known statistics about the total timber harvesting from TOF. However, very reliable estimates produced by accounting the harvesting permits extended by the Ministry of Environment and Development (MINAE) leave us with the alert that timber is coming from other sources rather than only productive forest. According to Gonzalez and Lobo (1999), harvesting trees on pastures and agriculture areas, among others are in the range of 30 to 45% of the total harvested in the country in 1999. This without considering the illegal cutting. For 1998, the same study shows estimated volumes of approximately 447.344 cubic meters, out of which 228.982 correspond to TOF (51.2% approximately) and 248.362 is the volume coming from productive forests.

In spite of all the efforts coming from the public sector as well as from the private one, illegal deforestation still persist. MINAE, SINAC and the National Forest Office (ONF) as public sector have been joining initiatives with several NGOs such as CODEFORSA, FUNDECOR, JUNAFORCA and others, in order to stop the illegal cutting. TOF are also illegally providing a great deal of raw material, especially timber to sawmills in Costa Rica, but other cause of such underground activity is the land use change towards more profitable economic activities (Campos, et.al., 2001), and another reason why deforestation continues is the scarce forest and TOF management knowledge, the believe that there is not value attached to TOF and the need for immediate sources of income.

According to Campos, et al, 2001, there is no clear definition of illegal harvesting in the forest law, neither an efficient State Administration Office to enforce the law. He also states that the illegally extracted and commercialized timber in Costa Rica come from four different sources:

- a. Trees from pastures (TOF)
- b. Trees from primary forest without land use change objective,
- c. Remaining trees from intervened forest with management plans, and
- d. Trees from secondary forest with the land use change.

The owners of small and medium size farms are the ones who have been taking advantage of goods and services coming from TOF. Agro forestry and silviculture systems have included TOF products as part of the system, but also several services, such as soil recuperation, spring water protection and others have benefited them. Additionally, from the economic and financial point of view these trees represent in many cases, a complement or an extra income for the farmers.

Trees with annual and perennial crops, silvopastoral land, living fences, tress alones and mixed and associated trees with agriculture, trees in pasture and forage are common types of existing TOF in Costa Rica. These kind of relationships, including the names of the most common species used is documented by Current et al (1995) and shown in table 5 bellow.

Table 5
Major Agroforestry Systems Found in Costa Rica

Agro forestry System	Species	Products and Services
Trees with perennial crops	Cordia alliodora, Coffea arabica Cordia alliodora, Coffea arabica, Erythrina poeppigiana Cordia alliodora, Theobroma cacao Cedrela odorata, Citrus spp., Inga spp. Musa spp., Coffea arabica Alnus acuminata, Coffea arabica	Shade, timber, coffee Shade, timber, coffee, nitrogen and organic matter Shade, timber, chocolate Shade, timber, coffee, fruit, fuel wood Shade, timber, nitrogen and organic matter
Silvopastoral	Alnus acuminata – Pennisetum Clandestinum, Pennisetum purpureum, Axonopus scoparius Cordia alliodora, Erythrina poeppigiana, Psidium guajava, Guazuma ulmifolia in pastures	Timber, forage, nitrogen and organic matter Timber, fuel wood, fruits and pasture
Living fences	Bursera simaruba, Gliricidia sepium, Erythrina poeppigiana	Fence posts, fuel wood
Isolated trees	Cordia alliodora, Cedrela odorata, Bombacopsis quinatum	Timber shade

Source: Current, Dean. et. al Costs, Benefits, and Farmer Adoption of Agroforestry, pág. 56.

Finally the official Forest National Development Plan (PNDF in Spanish), estimates that 25% of the commercialized wood in the country, is coming from natural forest, pastures and other TOF in illegal manner. McKensie (2000) estimates were a total cutting of 814,028 m³, therefore a the illegal part amounts to 284,910 m³.

According to the above arguments, it is necessary to improve TOF social, cultural, environmental and economic valuation. Again, it is necessary to institutionalize a new concept, or to develop a new paradigm for TOF. This may be related to the system of innovation which is in formation in Costa Rica, which includes environmental services into the economic scenario.

Reviewing the following table, number 6, we may identify all the different goods and services coming from TOF. In the same way that we detailed forest services in table 4 divided into the ones enjoyed by the private owner, the national beneficiaries and the international community, here we may divide TOF services. The necessary exercise again, is to create an innovation, which allow us to internalize these positive externalities. The innovation must consist on creating the necessary institutions and organizations to treat these services in the same way that if they were “commodities”.

TOF environmental services	Private ownership	National	Inter-National
Wood	X		
Fire wood	X		
Medicinal plants	X		
Shade on pastures	X		
Winde break	X		
Soil erosion control		X	
Living fences	X		
Forage	X		
Scenic beauty		X	
Urban ornamental		X	
Recreation		X	
Biodiversity			X
Carbon Sequestration			X
Water cycle maintenance		X	

According to table 6 there are already several services in the hands of TOF private owners; therefore there would be necessary to increase the information available to them and increase the learning process, for them to really take into account what they have and what they should manage. Some incentives –third generations incentives—may be created to assure this appropriation. These incentives include training, capacity building, awareness, facilitating information, advise and other services which indirectly help producers to participate in the market, but it is not a cash subsidy such as other kind of incentives which we were accustomed to.

There are several opportunities and potential benefits from TOF which could improve people's livelihood. They could be mixed with other economic and social activities, for instance:

- Increasing incomes and decreasing costs: The farm will have income diversification (selling products such timber, fruits and others)
- Reducing costs of external inputs (substituting fertilizers, maintaining water availability, maintaining biological control).
- New agro-business activities may emerge if using domestic animals and observable biodiversity to attract agro and silviculture sustainable tourism.
- New research and cooperation initiatives: Contracts with universities and research centers for teaching and research and to document economic and ecological changes.
- Taking advantage of the potential carbon sequestration at the national level. In the Costa Rican case with the hydrocarbons payment (PSA), but in other countries through innovative mechanisms that should be created.
- Payments from industries for water cycle maintenance, including brewery and soft drinks companies, hydroelectric projects and others.
- There is also willingness to pay from many people from urban areas to maintain forested areas, such parks, side wakes, streams and canals.
- There are probably several other examples.

6. Conclusions and recommendations

National legislation in Costa Rica is prohibiting the land use change; however, there is still illegal cutting of forested areas, and in the same way there is illegal and legal harvesting of TOF without considering the need to replant them. Other countries are very likely to facing the same problem. It is recommended to enhance awareness about the TOF benefits for the countries in general and people in particular.

TOF is providing with timber the industry in Costa Rica and also in other countries is happening the same. Therefore, it is very important to maintain and if possible to increase the TOF cover.

Environmental services coming from TOF are not valued by the markets or in other words they are treated as externalities in the economy. In this sense, there are already experiences such the one in Costa Rica, where the National System of Innovation in formation is transforming the institutional set up of the forest sector and it could do the same with TOF.

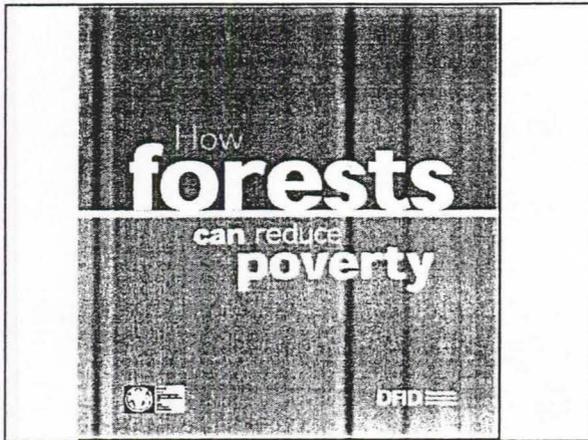
Environmental services are nowadays paid via the so called Environmental Payment Services (PSA) in Costa Rica; therefore, if there is enough documentation and prove about the similarities of TOF services, there should not be any question for applying TOF the same principle (producer paid principle as opposed with the polluter pay principle).

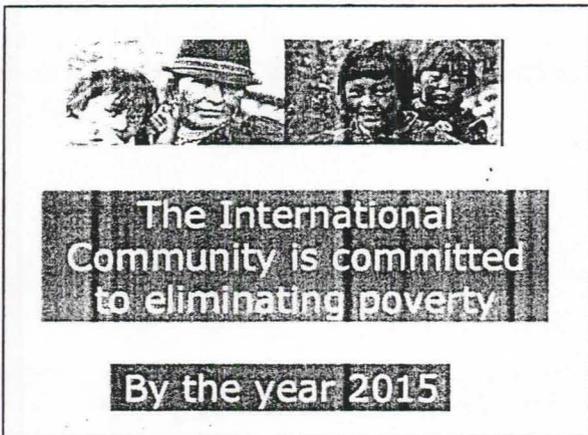
There is not enough awareness of TOF benefits, neither in the academia, rural and urban communities, nor the policy makers. In this sense the recommendation is to encourage the participation of TOF advocate people in seminars, workshops and international organizations meetings, in such a way that people realize of the importance of TOF. Additionally, documentation of different TOF management experiences and benefits from rural and urban areas is very important to be developed. Comparability of case studies is advisable.

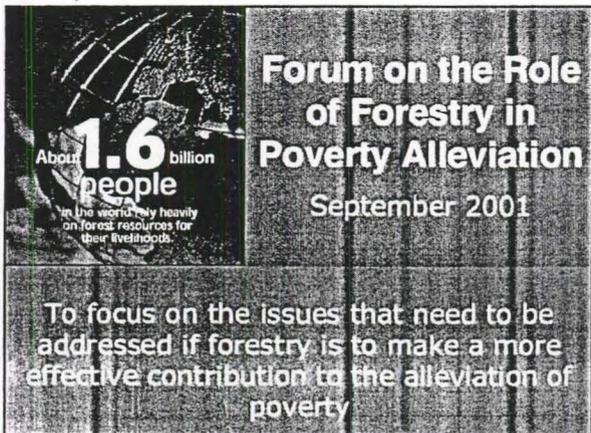
Finally, it is important to stress that TOF goods and services are multicultural and multi-sectoral. In other words, TOF benefits are related to different types of activities in different sectors (agriculture, households, cattle, tourism, urban development, etc) and many people will perceive them according to their cultural values. Traditional economics does not take into account many of these unmeasurable values; however, new approaches such that of ecological economics and systems of innovation have been developing techniques to consider all these kind of economic values, through different types of assessments (e.g. multi-criteria valuation). In short, research should be encourage assessing TOF from a holistic point of view including TOF monetary and non-monetary values.

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The Message



Forests and trees have an important role to play in the struggle to reduce poverty.



The challenge now is to take this agenda and turn this potential into a reality.





Expert Consultation on Trees Outside Forests

“Enhancing the Contribution of Trees Outside Forests to Sustainable Livelihoods”
(Rome, Italy 26-28 November 2001)

LOW FOREST COVER COUNTRIES AND THE TEHRAN PROCESS

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BACKGROUND

Since UNCED, the international debate on forest issues has captured the world's attention and has focused international political interest on the state of the world's forests. While particular concerns of the well-forested countries have been in the forefront of deliberations in international fora, the concerns of low forest cover countries, the overwhelming majority of which are developing countries, have been inadequately addressed so far. In these countries the lack of forests and wooded lands are particularly significant for rural populations in terms of their economic, social, cultural, environmental and subsistence contribution to livelihoods. Forests play a recognizable role in contributing to food security and to the protection of watersheds and eco-systems. Many of the roles and products once provided by forests are now provided by trees outside forests in these countries with a low forest cover.

In these low forest cover countries and particularly in arid zones, forests are disappearing faster than in most parts of the world. This is mainly due, among others, to strong and competing demand on forest and tree resources and failure of national forest and land use policies to adequately address the issues. Therefore, there has long been a felt need to rectify this situation through coherent and deliberate action plans and programmes. The Tehran Process (1999) which emanated from the initiative of Islamic Republic of Iran identified the needs of Low Forest Cover Countries (LFCCs) and those with unique types of forests.

THE TEHRAN INTERNATIONAL MEETING OF EXPERTS

The Open-ended international meeting of experts on *Special Needs and Requirements of Developing Countries with Low Forest Cover and Unique Types of Forest*, a government-led initiative in support of the programme of work of the Intergovernmental Forum on Forests (IFF), was held in Tehran, Islamic Republic of Iran, from 4 to 8 October 1999. The meeting was sponsored by the Government of the Islamic Republic of Iran, with the support of the governments of Canada, Denmark, Finland, Germany and Norway. It was organized with the collaboration of the governments of Egypt and Sudan, and in cooperation with international organizations, including FAO, the United Nations Environment Programme (UNEP), the United Nations Development Programme (UNDP) and the International Fund for Agricultural Development (IFAD). Seventy-seven participants from 39 countries and six international and bilateral organizations and NGOs attended the meeting.

The meeting was the first of its kind to address issues specifically concerning developing countries with low forest cover (LFCCs) and unique types of forest, including the special needs and requirements of millions of people that live in and around them.

The long-term objectives of the meeting were to:

- initiate a process towards placing the issue of low forest cover on the political and policy agenda of future international forest policy deliberations;
- foster national forest programmes in all LFCCs, and promote regional and sub-regional arrangements for the exchange of experience and for support to national processes, in partnership with the international donor community;
- establish linkages between action developed by LFCCs and the objectives of the three UNCED global environmental conventions (Convention to Combat Desertification –CCD-, Convention on

Biological Diversity –CBD- and United Nations Framework Convention on Climate Change - UNFCCC-);

- establish linkages with the activities of other relevant multilateral organizations;
- develop a strategic approach in order to call the attention of the international community to the needs of LFCCs.
 - identify common areas of cooperative action through networks, regional projects and other joint efforts, as well as through building partnerships between countries and with international organizations and donors;
 - promote research on low forest cover issues, including social, cultural, economic and environmental aspects;
 - formulate long-term approaches and strategies to address issues related to low forest cover;
 - devise appropriate follow-up mechanisms to pursue implementation and further development of the outcome of the Tehran meeting;
 - identify areas of common interest and synergy for action between low forest cover countries and those engaged in combating desertification.

THE TEHRAN DECLARATION

In addressing the objectives of the expert meeting, the participants adopted a report containing a set of conclusions and a number of short- and long-term concrete and practical recommendations. Within the overall framework of global collective endeavours for management, conservation and sustainable development of all types of forests, the participants emphasized that the long-term objectives including, inter alia, placing the issue of low forest cover countries on the political and policy agenda of future international deliberations on forests and other development issues, including combatting desertification, and formulating long-term approaches and strategies. Priority should be given to enhanced cooperation among LFCCs, partnerships with multilateral organizations and instruments as well as with the donor community.

The meeting endorsed the proposal to launch a process, hereafter called the "**Tehran Process**", in order to achieve these collective objectives and to pursue the implementation and further development of the outcome of the Tehran meeting was further emphasized by the participants. The participants reaffirmed their commitment to the objectives of the "**Tehran Process**" and reiterated the necessity of active, cooperative and consistent follow-up of the final outcome of the Tehran meeting aimed at fulfilling critical human needs in low forest cover countries.

THE TEHRAN PROCESS

The Process would provide a forum to address the specific needs of developing countries with low forest cover and to place the issue of LFCCs on the political and policy agenda of future international deliberations. The process should be action-oriented, should secure political support and guidance, and serve as the focus for:

- collection, analysis and dissemination of data and information;
- exchange of information and experience;
- capacity building, especially related to the collection of timely and reliable data and its processing into information and knowledge;
- the quantification of non-marketed goods and services and their reflection in national accounts, including the contribution of trees, forests and woodlands in LFCC to food security;
- the development of criteria and indicators for sustainable forest management for LFCCs, benefiting from the existing processes, particularly Dry-zone Africa and the Near East;
- conduct of joint research projects on issues affecting low forest cover countries, particularly the development of models for the management and rehabilitation of natural forests and woodlands;

-
- the development of a definition of low forest cover that more precisely identifies countries is falling within this category.

Policy, Planning and Institutions

It was recommended that forest policy in many LFCCs needed to be reviewed, taking into account broader perspectives and the wide variety of needs and demands from society, which can be fulfilled by the forest sector. There is a need to facilitate the building of partnerships to reduce conflicts with other sectors, but also taking into account the environmental, social and human aspects of forest and rangelands to secure the livelihoods of people in rural areas.

Increased emphasis is required in developing new policies for the forest sector in the following fields:

- Non-wood forest products;
- Increased market orientation of locally-produced forest products;
- Services, including the provision of clean water, soil and water conservation with particular reference to fragile ecosystems, desert control, and protection from the effects of wind and water;
- Food security, including the provision of fuelwood, and fodder;
- Carbon sequestration;
- Conservation and utilization of biological diversity.

Participatory Processes

Rehabilitation of forest, woodland, tree and rangeland resources will require the active participation of rural communities.

Programmes aiming at reversing deforestation and forest degradation must be formulated and implemented with the effective participation of the concerned population, including local as well as indigenous communities.

Participatory approaches should generate income and employment and should be based on existing cultures; they should involve local as well as indigenous communities, with special consideration given to nomadic and transhumant peoples, to forest dwellers and to the role of women and youth. Full use should be made of traditional forest-related knowledge (TFRK).

LFCCs should support and facilitate an increased role for non-governmental organizations (NGOs), including providing assistance to:

- strengthen and improve the organization of rural communities;
- strengthen their capacity for planning and decision-making;
- provide technical information and training; and
- formulate and develop national forest programmes.

FOLLOW-UP TO THE TEHRAN MEETING

Shortly after the international meeting of experts, a Secretariat was established by the Islamic Republic of Iran to lead and coordinate regional and international efforts in terms of follow-up, namely to:

- place key concerns on the political and policy agenda in future international deliberations;
- prepare approaches and strategies based on the report of the Tehran meeting;
- enhance cooperation among LFCCs and partnerships with organisations, institutions and donor countries, including the exchange of information and experience; and
- implement the recommendations of the meeting.



Sustainable Forest Management in Low Forest Cover Countries

Project Supported by FNPP

Presented by Jim Carle
FORM





Uniqueness of LFCCs

Forests & TOFs Values:

- economic
- social
- environmental
- cultural



FAO, Forests and Forestry





Uniqueness of LFCCs

Causes

- physical conditions
- population pressure
- abject poverty
- food security
- fuelwood
- livelihoods

Effects

- deforestation
- forest degradation
- loss of productivity
- loss of biodiversity
- lower quality of life

FAO, Forests and Forestry

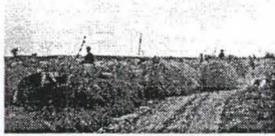




Tehran Process

Main constraints - planted forests, TOFs and NWFPs:

- Weak resource data
- Under-valuation
- Weak legal, policy & institutional frames
- Limited application of sustainability
- Limited participatory planning





Tehran Process

Recommended Actions:

- Collect resource data
- Strengthen Institutions
- Do Participatory Planning
- Develop C&I for SFM
- Increase role of planted forests, TOFs, NWFPs
- Establish Networks
- Support LFCC Secretariat

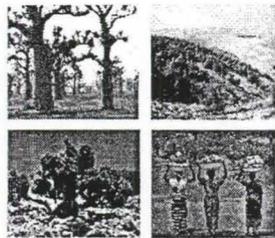




FNPP Proposal

Sub-components:

- Develop & implement Criteria & Indicators
- Enhance role of planted forests
- Enhance role of TOFs and NWFPs





FNPP Proposal

Key Collaborators with FAO:

- LFCC Secretariat,
ACSAD, AOAD
- SADC, CILSS, IGAD, ATO
- UNEP, ICRAF, IFAD, CIFOR, ITTO, IUCN
- Regional Forestry Commissions





Criteria & Indicators

- Validated C&I for Dry Zone Africa & SADC and CILSS initiatives
- Validated C&I for Arid Zone N. East
- Guidelines for Dry Forest Asia initiative
- International meeting on C&I for LFCCs to derive actions
- Reports on national level C&I





Role Planted Forests

- Case Studies in Iran, Tunisia, Oman
- Case Studies in Mali, Namibia, Ethiopia
- Regional Workshops
 - Nairobi, Kenya
 - Tehran, Iran
- Priorities for future support





Role TOFs and NWFPs

- Case Studies in Iran, Tunisia, Oman
- Case Studies in Mali, Namibia, Ethiopia
- Regional Workshops
 - Nairobi, Kenya
 - Tehran, Iran
- Priorities for future support





Implementation Status

- Contracts for validation of C&I established
- Consultant selection for case studies in planted forests, TOFs and NWFPs underway
- Pre-planning for Regional workshops commenced
- Identification and dialogue with collaborators





Future Support

- Current project support until 31 Dec 2002
- Proposals will be prepared for FNPP and other donors to consider support in selected countries beyond



**POLICIES, STRATEGIES AND APPROACHES OF TREE
PLANTING IN THE SAHELIAN COUNTRIES :**

CASE STUDY OF NIGER REPUBLIC

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At

**The Expert Meeting on Enhancing Trees Outsides the Forests Contribution
to Sustainable Livelihood**

FAO HQ, Rome Italy, 26 – 28 November 2001

ABSTRACT

Food self sufficiency and desertification control have been for long term the two priorities objectives of the Rural Economic Development Policy of NIGER Republic.

In the forestry sector, these priorities objectives have been taken into consideration through the definition of the forestry policy whose main objectives were :

- Protection of the degradation phenomenon of the major ecosystems ;
- Satisfaction of the population basic needs relatively to the forest produces such as wood for fire wood and services.

In order to implement these policies, many strategic measures have been taken by the various Governments depending on the currently occurring environmental situations faced by the country.

These political strategies have witnessed many changes and adjustment over the years, either as a result of the political leading team's ambition, or as a result of the general environmental constraints faced by the country. About four distinct political periods could be identified in Niger.

During the first steps of the newly born post-colonial Niger, the forestry policy was characterized by a pure conservation and protection strategy based on the rules inherited from the colonial days. The fundamental political aspect during this period was the total restriction of tree exploitation. The 1974 Forestry Law is a perfect illustration of those years policy.

The severe droughts of 1972/73 and 1983/84 have seriously threatened the socio-economic development of the country. A national debate was organized and the economic development policy and strategy were centered around food self-sufficiency and environmental protection. Many Agricultural Production's Improvement Projects were launched and executed during the period. Examples of these projects are *Projet Intégré Keita*, *Projet Basse Vallée de la Tarka*, *Projets Agrofforestiers Tahoua, Maradi, Tillabery* the output of which are easily perceptible on the field.

Between 1985 and 1989, the first generation, sector-oriented projects were re-oriented and reformulated into new programs and projects based on the global and integrated approach for dealing with desertification. A National Plan for Combating Desertification was elaborated in 1985 and adopted by NIGER Government. It was revised in 1991 to serve as a National Political and Strategic Reference for Desertification Control with a global and integrated vision and full involvement and empowerment of the population in the management of the natural resources in their territory.

National Conference and the Democratic process are the major events that profoundly dominate the history of NIGER during the last years of nineties. Great debates on the strategies for desertification control and food self sufficiency, the global and integrated vision for desertification control have been the major issues discussed nation wide. The promulgation of Law N°92-030 relatively to General Principles for a Rural Development Policy in NIGER, one of the axis of which is Natural Resources Management based on the approach *Gestion de Terroir* was the out come of this new development.

In sum, between 1990 and 2000, very important activities have been realized in various parts of the country in matters related to soil and water conservation, sand dunes stabilization, plantations, degraded soil restoration by fencing (natural regeneration), etc. Some of these agroforestry activities are discussed in this paper, most especially as regard to supporting project and the strategies used in achieving these results. A brief introduction on the on-going Strategic Document on Poverty Reduction (DSRP) is also conducted outlining the major strategic axis for sustainable poverty alleviation.

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I. INTRODUCTION

Food self sufficiency and desertification control have been for long term the two priorities objectives of the Rural Economic Development Policy of NIGER Republic.

In the forestry sector, these priorities objectives were taken into consideration through the definition of the forestry policy which main objectives were :

- improvement on the knowledge of the forestry constraints ;
- research on the complementarities between trees and the agricultural activities in rural areas known as *agroforestry*.
- Conservation and protection of biological communities in a stable equilibrium;
- Protection and rehabilitation of the degraded ecosystems ;
- Satisfaction of the population basic needs relatively to the forest produces such as wood for fire wood and services.

In order to implement this policy , many strategic measures have been taken through the time by the various Governments depending on the currently occurring environmental situations faced by the country.

These political strategies have witnessed many changes and adjustment over the years, either as a result of the political leading team's ambition, or as a result of the general environmental constraints faced by the country.

In this paper, we will look at the trends of these policies and strategies and the various accompanied measures taken in the forestry sector from the independence days to about ten (10) years after the World Wide Known United Nations Conference on Environment and Development. Emphasis will be laid on the various activities taken to environmental protection and food production improvement through various programs or projects financed by donors agencies or by the individual efforts of various Governments.

II. GENERAL BACKGROUND

NIGER Republic is a landlocked country of about 1 267 000 km² located in the hearth of Africa between Longitude 0°16' and 16° East and the Latitudes 11°01' and 23°17' North. It is one of the Sahelian countries severely treated by drought (¾ of the country is desert) and desertification.

The climate is arid and semi-arid and is characterized by four main seasons : a hot season between October and November ; a dry and cold season between December and February; a dry and hot season between March and May; and a rainy season between June and September.

Rainfalls are characterized by high variations in time and space. Four distinct zones could be identified in relation to the total amount of rain fall recorded each year, and these are :

- the sahelo-soudanian zone. It represents about 1% of the total land area of the country and receives between 600 and 800 mm annually.;
- the sahalian zone covers about 10% of the total land area of the country and receives between 350 and 600 mm each normal year;
- the sahelo-saharian zone of about 12% of the total land area of the country receives between 150 to 350 mm par year;
- the saharian zone, the most important part of the country covers about 77% of the land area of the country, but receives only between 0 and 150 mm of rain fall each year.

The population increases with an exponential rate. It was about 4 millions in 1960, year of its independence. It was estimated at about 5.1 millions in 1977 with a growth rate of 2.7%.(RGP, 1977). In 1988, the second General Population Assessment estimated the population at about 7.2 millions, with a growth rate of 3.2%, one the highest in the world. The 2000 General Population assessment gave a provisional figure of about 11 millions.

The main characteristic of this population is that, it is mainly rural (85%) and mostly concentrated in the agricultural zone, i.e. in the little band receiving between 350 and 800 mm of rainfall which is only about ¼ of the total land area of the country.

The harsh climatic conditions and frequent droughts, coupled with the increase in the population has led to serious environmental degradation and continuous depletion of the existing little forest resources.

Thus irregularity of rainfall, lack of fertile land and reduced financial resources have led to decrease in the production of basic staple food, frequent famines, scarcity of fuel wood and drastic reduction in the revenues of the rural population.

Also, the continual cultivation of fragile land with no supplementary amendment led to decrease in land productivity and the reduction if not the total elimination of fallow system.

In order to remedy the situation, urgent steps have been taken by the Government of NIGER. A Rural Development Policy was designed which main objectives were food self sufficiency and environmental protection. Many strategies have been adopted over time in order to meet these objectives.

As far as the forestry sector is concerned, the major political and strategic changes witnessed by NIGER Republic could be easily identified during the following periods.

III. MAJOR CHANGES IN NIGER REPUBLIC FORESTRY POLICY

The Forestry Policy in NIGER has witnessed changes from the period of independence to the present days. These changes over time were mainly based on the changes of the environmental problems faced by the country, which greatly affect the objectives of the economic development. The availability of trained qualified forestry personal from various backgrounds and the changes in the global environmental policy have also greatly affect the forestry policy in NIGER. These majors changes in the forestry policy could easily be apprehended through the following periods :

3.1 Period of 1960-1970

The forestry policy during this period was characterized by a pure and strict conservation strategy based on the rules inherited from the colonial days. The fundamental aspect of that policy was the total restriction of tree exploitation. The 1974 Forestry Law is a perfect illustration of those years policy.

Nevertheless, illegal felling and uncontrolled exploitation and destruction of the natural vegetation were frequently conducted by the local population who considered the forests as Government own properties, because they felt totally deprived of their rights on what they regarded as God own resources.

The major draw back of this policy is that, natural vegetation, instead of being protected and developed, was totally depleted. The advanced degradation of the natural resources has led to changes in the approach of natural resource management and proved the necessity to compose fully with the local people in the effort of desertification control and environmental protection.

3.2 Period of 1970 – 1984

This period was marked by two severe droughts (1972/73 and 1983/84). The economic development policy and strategy during the period were centered around food self-sufficiency and environmental protection. Many Agricultural Production's Improvement Projects were launched and executed during this period. The period has also witnessed profound mutations in the rural development policy defined during the last decade.

In the forestry and the environmental management, the conservation policy of the sixties was replaced by a participatory desertification control policy. It's in fact during this period that forestry sector has witnessed a profound revolution characterized by the change in the approaches and the strategies which make rural population's participation and involvement a key factor for the success of forestry activities in the field.

It's also during this period that the forestry activities were fully developed in NIGER. A recent evaluation conducted in the process of PNEDD elaboration (1998) came out with about fifty (50) forestry projects financed by Government with the support of external partners. Thirty eight percent (38%) of these projects have put emphasis on the promotion of trees on the agricultural systems, 14% on the creation of village woodlots, 8% for gum belt rehabilitation, 4% for the management of *Borassus aethiopum* forest (Rôneraies), and the remaining 36% for the establishment of green belts round major cities (Niamey Green belt, Tahoua Green Belt, Maradi green belt and Zinder green Belt), sand dunes stabilization, soil and water conservation activities.

A close examination of these projects reveal a general tendency towards the promotion of the developmental forestry among the various beneficiaries. Unfortunately, the forestry development policy implemented by the majority of these projects has not also fully taken into consideration some majors important social factors. This shortcoming led to many failures observed here and there during the execution of some of these projects.

Nevertheless, the relative success achieved by some agro forestry activities gave birth to a new concept and approach based on the absolute necessity of a general mobilization of the population and their effective participation and involvement in the implementation of popular actions of environmental protection and reforestation (community forestry).

In order to design policies and strategies appropriate for the implementation of the community forestry approach, a national debate was conducted in Maradi in May 1984, the outcome of which was the adoption of a document known as *MARADI ENGAGEMENT*. This political and strategic document contains four main priority objectives as follows:

- assure food security ;
- satisfy the population needs for wood for fire-wood and services ;
- restore and protect the environment ;
- elaborate a national plan for desertification control and mobilize the entire population through a national youth service.

One of the measures retained by the Government after this important meeting, as far as the forestry sector is concerned, was plantations establishment at an annual rate of :

- 5 hectares at local administrative level;
- 10 hectares at the sub-regional level;
- 15 hectares at the regional level.

Similar measures were taken at village level, on the irrigated farms and others public places like mosques, markets and schools.

Maradi Engagement had in fact ignited a constant dynamic in matter related to reforestation. This dynamic was earlier fortified by the institutionalization of August 3rd (the independence day) as a tree planting day throughout the country.

3.3 Period of 1985 – 1989

Few months after MARADI debate, a sub-regional meeting was conveyed by the CILSS Executive Comity on the theme Desertification Control. The outcome of the meeting known as the NOUAKCHOTT STRATEGY brought about a new concept based on *a Global and Integrated Approach for Desertification Control*. This concept was later adopted by the Member States.

Thus, between 1985 and 1989, the first generation sector-oriented projects were re-oriented and reformulated into new programs and projects based on the global and integrated approach for dealing with desertification. A National Plan for Combating Desertification was elaborated in 1985 and adopted by NIGER Government. It was revised in 1991 to serve as a National Political and Strategic Reference for Desertification Control with a global and integrated vision and full involvement and empowerment of the population in the management of the natural resources in their territory.

Unfortunately, the frequent institutional instabilities which characterized this period have not allowed a good implementation of these second generation projects. Nevertheless, some projects like *Projet Intégré Keita*, *Projet Basse Vallée de la Tarka*, *Projets Agro forestiers*

Tahoua, Maradi, Tillabery came out with good results easily perceptible in the field. (tables n° 1 to n°3).

3.4 Period of 1990 – Nowadays

At national level, this period was characterized, by a profound socio-political changes (National Conference, Democratic process, etc.) and great debates on the last decades policy and strategies for desertification control and food self sufficiency. The global and integrated vision for desertification control and food self sufficiency was concretized in July 1992 by the promulgation of the Law N°92-030 relatively to the General Principles for a Rural Development Policy in NIGER one of the axis of which is Natural Resources Management based on the approach *Gestion de Terroir Villageois*. (Villages Territory management).

It was also during this period that the Tropical Forestry Action Plan was elaborated for the management of the depleting natural forest resources. Unfortunately this plan has not been adopted. Nevertheless, some important natural forest management programs have been implemented. Examples include Forest Management by local people (Projet Energie II); Natural Forest Stands Management (Guesselbodi, Hamadide, Goroubassounga, Baban Rafi, etc.).

Thus between 1990 and 1998, very important activities have been realized (tables n° 3 and 4) various parts of the country in matters related to soil and water conservation, sand dunes stabilization, plantations, degraded soil restoration by fencing (natural regeneration), etc.

The cumulative results of these activities are (PAN/LCD/GRN, 2000):

- 180 000 ha and 6 300 km of soil and water conservation;
- 7 000 ha of sand dunes stabilization and 11 300 ha of natural regeneration protection ;
- 48 500 ha of bloc plantations and 20 000 km of linear planting (road sides, farm boundaries, live fences, wind breaks, etc.)

At the international level, the United Nations Conference on Environment and Development of June 1992 (the Earth Summit) has brought about other concepts of environment and development, sustainable development which are now progressively taken into consideration in the present policies and strategies for sustainable development. A National Plan for Environment and Sustainable Development (PNEDD) was elaborated and adopted containing six priority programs, one of which is the National Action Program for Combating Desertification and Natural Resources Management (PAN/LCD/GRN).

The PAN/LCD/GRN was elaborated through the down-top process and was examined and adopted by thousands of representatives from various corners of the countries. It was later adopted formally the Government in January 2000. It's now the NIGER national reference on these matters.

Other legislative measures were taken through the promulgation of some basic laws which specified the use of and utilization of environmental resources. Some of these laws are :

- Law n°98-56 of December 29th ,1998 relatively to Environmental Management;

- The revision of the 1974 forestry law with the support of the FAO
- Law n°97-001 of January 10th, 1997, relatively to the institutionalization of the Environmental Impact Assessment and Evaluation;
- Law n°92-037 of August 21st relatively to the organization of the actors (villagers, wood transporters and wood exploiters) and the relevant differential taxation;
- Law n° 98-042 of April, 1998 determining the fishing systems in NIGER;
- Law n° 98-048 of December, 1998 determining the hunting activities in NIGER.

Recently, the Ministry of Hydraulic Environment Desertification Control has launched a short and mid term Action Plan for combating desertification with five main fields of intervention or programs below :

- desertification control and natural resource management ;
- management of biological diversity;
- environmental protection;
- Strengthening the local capacities;
- Monitoring and Evaluation of the action plan.

The objectives of the action plan are three holds :

- Improve the contribution of the forestry sector in food sufficiency through the improvement of the production potentials of the natural resources ;
- Increase the contribution of the forestry sector in alleviating poverty and improving the national economy through the development of high yielding activities in matters related to fisheries, hunting and forest resources management.
- Improve the living conditions of the population, most especially in the rural areas.

The strategic measures designed in implementing this environmental and desert control policy is based on the following axis :

- intensification of participatory forestation with local tree species of high economic values such as gum tree;
- valorization of non wood products such as gum Arabic and fruits of *Prosopis chilensis*, *Azadirchta indica* (pesticide production);
- watershed management and soil conservation;
- valorization of natural and artificial water bodies through fingerlings introduction and intensification of fishing activities;
- improvement of wildlife management and rearing;

- mobilization of the local productive forces such as youth and army forces for the rehabilitation of degraded land;
- promotion of the renewable natural energy such as natural charcoal, solar and wind energy;
- development of integrated trans-boundary programs and projects in matters related to environmental protection and desertification control.

Field activities will essentially be based on :

- One village , one woodlot;
- One water body, one fishery and one wood lot;
- Each agricultural farm delimited by a plantation;
- Each school or a health center planted;
- Each human settlement freed of garbage.

Also, the DSRP (Strategic Document for the Reduction of Poverty) actually in the process of examination and adoption. It's major objectives for reducing the increasing poverty of the rural people is sought through the sustainable utilization of the existing available natural resources. The multidisciplinary approach and the holistic strategy of the DSRP Program give hope for the concrete actions and tangible results in the fields.

IV. EXAMPLES OF MAJOR ENVIRONMENTAL PROTECTION ACTIVITIES

From independence to date, many projects and programs have been executed in the forestry/environment sector. A close examination of the life span of these projects and programs reveal that majority of them (90%) have been sponsored during the seventies, that is, after the 1973/1974 drought which has severely destroyed natural resources and led to serious environmental degradation. Some of them started around the eighties in the areas of natural forest management for the supply of fire wood and the environmental rehabilitation through the establishment of plantations.

Most of these projects and programs have not met the expectations mostly because of :

- land tenure (land is own by Government);
- insufficient implication of the population;
- sector oriented actions;
- use of exotic species with no understood silviculture ;
- use of planting materiel of unknown origin;
- lack of follow up after the projects;
- climatic and soil conditions not fully taken into consideration.

Nevertheless, some land rehabilitation activities such as river bank protection, sand dune stabilization, watershed protection and some agroforestry activities such as protection of natural regeneration, tree on farm land or farm forestry, wind-breaks, live fences, etc. have known relatively good success, because they have fully implicated the population.

4.1 Industrial plantations

The industrial plantation started in the eighties with the *Projet IDA/FAC/CCCE*. This project had known three consecutive phases with the main objectives of providing fuelwood for urban center like Niamey, Tahoua, Maradi and Zinder. The total outcome of this project, in term of plantation establishment, is summarized in table n°5).

4.2 Forest management activities

The natural forest management activities started in NIGER in 1982 by USAID at the Guesselbodi natural forest through a project known as *Projet Planification et Utilisation des Sols Forestiers (PUSF)*. The main objective of the project was to test the capacity of the *Combretacea* forests in satisfying the need of fuel wood for some urban centers such as Niamey, Maradi, Zinder and Tahoua.

The project, first aimed at satisfying the need of fuel wood to urban centers based on the inventory of the available wood resource in the forest; and secondly, how the local neighboring population could be involved in the management of the forest, through what was then called the *inter-village forestry cooperatives*.

These inter-villages forestry cooperatives have not met the expectations mainly because :

- the limited quantities of wood made available on the markets have no effect on the wood demand ;
- the decision making organs of the cooperatives have been monopolized by some self-proclaimed individuals with no respect to the retained management technical options.

Therefore, this approach of sustainable management of the natural forest by the local people's through inter-village cooperatives systems has to be rethought.

The challenge for another natural forest management project sponsored by DANIDA (*Projet Energie II*) was therefore to pass from the heavy and non expandable cooperative system, to a simple and easily replicable system of forest management system y local people through the rural wood market managed by the so-called *Structure Local de Gestion* (Local Management Structure) based on a new natural forest management policy – *la stratégie Energie Domestique* (Domestic Energy Strategy). The approach advocated here is that the village forest is demarcated by local under the supervision of the forestry agents. A consensual management plan is negotiated and elaborated by the concerned actors. The financial resources gained through the exploitation of the forest is shared as stipulated by the law n°92-037. The 2000 financial output of these rural wood market is presented in table n°6.

This natural forest management strategy is actually pursued by the *Projet Energie Domestique* in various parts of NIGER, over various types of natural vegetation.

4.3 Agro forestry systems practiced in Niger

Agro forestry as a sustainable land management system which increases the over all yield of the land by combining the production of crops (including tree crops) and forest plants and animals simultaneously or sequentially on the same unit of land and applying management practices that are compatible with cultural practices of the local people started in NIGER many years ago.

These activities formally started in NIGER in 1974 by CARE International with the Tahoua Agro forestry Project which main objective was to combat the decrease in land productivity caused by the wind erosion in the Majjia valley of Bouza. Some years later, the project was extended to Keita Local Government with the sand dune stabilization around Yagalalane village.

In 1984 the project was extended to Madaoua, Illéla, Konni Local Government areas respectively in the valley of Tarka and Maggia, Badaguichiri and around irrigated Perimeter of Konni.

In 1985, another Agro forestry was launched in Tillabery area with the general objective of "helping the farming cooperatives and individuals to increase the fertility of their land and increase the vegetation cover in the project zone.

Around the same period, another Agro forestry project was launched in Maradi with the objective of "preserving one of the last natural forests of Niger based in the rational exploitation of wood and non wood produce.

Around 1988/1989, another project – the Semi Arid Land Management Project (SALAMA) started in NIGER with three branches in the areas of Tahoua Tillabery and Maradi. Its main objectives is the establishment of windbreaks on farmlands to protect arable crops from erosion, increase soil humidity and soil organic matter, increase the supply of wood for firewood and services.

The major agro forestry activities practiced in NIGER include :

4.3.1 Trees on crop land / farm forestry/parkland system

This system is characterized by mature trees dispersed in cropped fields. It is the largest single agricultural land use in the sub-saharan Africa (Hervout, 1990, cited by Vandenbeldt, 1992).

In Niger, trees of different species are left on farm land growing along with agricultural crops. Some of these tree species are planted or often preserved for their beneficial effects on soil and crop yields known by farmers and in some cases demonstrated by the research. Examples of these species include *Acacia albida*, *Acacia senegal*, *Balanites egyptiaca*, *Acacia nilotica*, *Butyrospermum paradoxum*, *Neocarya macrophylla*, *Hyphaene thebaica*, *Parkia biglobosa*.

The ability of these various parklands to enhance and stabilize crop production has not been much studied. Over the past twenty (20) years, *Acacia albida*/grain combination has been

given much attention in west Africa. Estimated of 100% increased in grain yields were reported by (CTFT, 1988) under *A. albidal* grain combination.

No comparative data are available from NIGER, but it is believed that crop yields are also higher when grown under these parks. otherwise, the farmers would not have taken the task of preserving these trees.

4.3.2 Sylvopastoral system

There are many systems of animals husbandry in the semi-arid tropics, but two extremes could be identified. The first, where animals are permanently feature in the farming system or stall-fed with supplemental pasturing. The other is the nomadic transhumance system of the Sahel as in the case of NIGER, where animals are move from one site to another according to the changing pasture conditions throughout the year, or herded to distant pasture during the rainy season to protect crops (vandenbeltdt, 1992). In both cases, the animals play a very important role in sustaining field fertility through manure production.

In NIGER, or in the sahelian agricultural zones, in general contract of parking are signed with herders in order to bed animals on arable fields during the dry season, thereby fertilizing the fields. The animals herders are remunerated either in cash or in kind (cereals grain), or they are allowed to graze the crop remnants on the farms which will eitherwise be brought home.

4.3.3. Windbreaks

Wind break could be defined as barriers of live vegetation usually tree and shrubs planted in one or two rows at right angles to the direction of the prevailing winds. The decision on how wide windbreaks should be depends on the following factors:

- the amount of land which could be economically devoted to planting and the minimum number of rows required to maintain the desirable permeability(Peter and John (1983);
- the maximum effect that is expected from the windbreaks (Lowe, 1986).

The effects of windbreaks are almost without exception beneficial to the environment and they include :

- reduced evapo-transpiration, increased water availability for plants use and reduced water stress;
- reduced wind damaged to plants and animals;
- control of air temperature by leveling out the extreme fluctuations;
- provision of organic material for soil conservation and improvement ;
- provision of aesthetic values in areas where trees are scare.

Other benefits include:

- Increase in wood supply recognized by about 80% of the farmers interviewed in the majjia area of Niger during a study carried out by Denninson in 1986;
- Increase in the farmers annual income by about 30%. (by Denninson in 1986);

- Increase in crop production and grain yield : some critical studies carried out in the temperate regions and semi-arid tropics that confirm findings of increase crops yields behind windbreaks are reported by Vandenbeldt (1992). A 14% increase in millet yields behind *Eucalyptus camaldulensis* windbreaks were reported by Ujah and Adeoye in 1984 in northern Nigeria. In the Maggia valley of NIGER, 20% increase in the crop yield behind double-rowed *Azadirachta indica* wind breaks spaced 100 m apart were reported by Vandenbeldt in 1992

4.3.4 Shelterbelts/green belts

Green belt establishment have been experienced in NIGER since around the 70's i.e. after the disastrous drought of the 1973/1974. Many special projects were executed after the 70's relatively to environmental protection. Some of these were specially advocated to greenbelt/shelterbelts establishment around major city such Niamey, Tahoua, Maradi and Zinder.

The important example of these activities is Niamey greenbelt. It is a band of about 2 500 ha containing about one millions of trees mainly of *Azadirachta indica* and *Eucalyptus camaldulensis*. Other plantations in Niamey town include various wood lots which serve as recreational zones in the town. (Table n°7).

4.3.5 Road side planting/Amenity forestry

Road side plantations or avenues planting are conducted in Niamey with dominants exotics tree species such as *Azadirachta indica* and *Khaya senegalensis*, *Terminalia mentaly* and *Cassia siamea* (Table n°8). Nevertheless, *Khaya senegalensis* is becoming more and more rare as an avenues species, because it is seriously threatened by human for it barks used in the traditional medicine for the treatment of many diseases.

These species are either planted for their shade (*Azadirachta indica* and *Terminalia mentaly*) wind protection and fire wood production (*Eucalyptus camaldulensis*) and for medicine. The tolerable characters of the first two species make them well adopted and widely accepted and planted in all corners of NIGER. These two species could in fact be found in the most remote area of Niger. The neem species represents nowadays a sign of human settlement.

CONCLUSION

Trees have been and will always be part of the socio-economic systems of the Sahelian countries like NIGER. They are planted or preserved in the farms because of the very important role they play in all aspects of human life. Bada (1992)classified the role of trees in agro forestry as biological, socio-economic, cultural and aesthetic or non quantifiable.

The premises of agro forestry, according to Bada (1992) are biological, socio-economic, cultural and aesthetic or non-quantifiable:

- The biological roles include all the positive influences of the tree on soil and environment, such as closed and efficient nutrient cycling, maintenance of soil organic

matter, prevention of run-off and soil erosion, regulation of micro-climate, and above all, the adaptability of tree on soil that are capable of sustaining annual agricultural crops.

- The socio-economic factors that substantiate the potential value of trees are that the poor farmers in an environment of mounting pressure, are sometime forced to utilize inherent unproductive areas for food production. These farmers practice land management systems with disastrous consequences such as deforestation, desertification, floods, droughts and soil degradation. They should therefore be given an alternative system of land management that combines the practice of agriculture and forestry to provide food and wood without causing deterioration to the ecosystems (Nair, 1980).
- Trees on farms serve as an insurance against crop failure by encouraging mixed cropping whereby the total harvest from all the crops is greater than would otherwise be obtained from the sole cropping.
- other benefits trees are classified as cultural and aesthetic and these include beautiful leaf-flushes or flowers and reduction of carbon dioxide build-up by trees, thereby purifying the air and preventing ozone layer depletion.

The role of trees in sustainable development and their potential for poverty alleviation in rural areas could be perceived through the following identified goals :

- increasing diversified production, most especially under conditions of land shortage. This could not only be seen as a means to improve the availability of required agricultural and tree products, but also as a means to relieve pressure on valuable conservation areas;
- contributing to sustained production of agricultural crops, livestock and wood and non-wood tree products either on fragile lands, or in areas of lacking economic development and prevalence of low external input agriculture;
- contributing to land rehabilitation, hence increase in available cultivable land and production.

Unfortunately, these important roles of trees are not totally perceived everywhere and by every individual in the Sahel, that is why some supportive studies should be conducted in order to ascertain the role of the various parklands that exist in the agricultural systems of the Sahelian countries. Thus studies conducted by Ali Mahamane (1997) in Niger should be completed to cover the various parklands that Niger is endowed with.

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ANNEXES

Table n°1: Trends of seedlings production and plantations establishment in NIGER from 1984 to 2001

Year	Seedlings produced	Areas planted (ha)
1984	1 757 447	1 639
1985	4 818 590	2 004
1986	5 704 715	2 391
1987	6 592 999	2 190
1988	5 937 052	3 116
1989	7 350 809	3 066
1990	7 583 655	2 277
1991	7 819 543	7 317
1992	7 034 369	1 854
1993	6 163 342	5 915
1994	6 093 783	9 215
1995	4 692 534	2 452
1996	4 358 119	7 102
1997	4 491 681	5 087
1998	5 389 716	5 590
1999	7 108 848	6 752
2000	5 358 583	6 309
2001	13 766 132	11 955
Total	112 021 917	68 802

Table n°2: Plantations establishment carried out by CARE/SALAMA project in various parts of NIGER

REGION	Windbreaks (km)	Plantations (ha)	Number of trees planted
Dosso	10	87.6	30 971
Maradi	117	503.8	168 633
Tahoua	306	707	401 043
Tillabery	4	1 364.9	333 381
Zinder	-	175.6	58 523
Total	437	2 838.9	992 551

Sources : inventory of neem plantation, USAID, 1991

Table n° 3 : Some activities carried out by Projet Intégré Keita (Soil conservation and afforestation)

Type d'intervention	Phase I (1984/1991) (ha)	Phase II (1991/1996) (ha)	Phase III (1997/2001) (ha)	Total
1. Soil conservation				
Sylvo-pastoral	10 239	4 222	60	14 521
Agro-sylvo-pastoral	6 653	2 177	210	8 980
2. Seedlings produced & planted	7 217 000	7 416 845	863 820	15 497 665

Source: PDR-ADM/Keita, 1998 : Présentation et quelque éléments de réalisation

Table n°4 : Trends of Agro-Sylvo-Pastoral project (PASP) activities from 1991 to 1999

	Nombre de terroirs	Production de plants	Protection de la RN	Ensemencement des herbacées (ha)	Ensemencement des ligneux
1991-1992	3	-	Nd	8	-
1992-1993	3	52.227	Nd	582	400
1993-1994	6	99.653	11.000	2.122	1.100
1994-1995	11	56.201	20.000	1.220	1.220
1995-1996	14	42.675	45.000	465	350
1996-1997	14	36.921	67.000	150	350
1997-1998	23	81.178	128.000	700	530
1998-1999	23	31.381	170.000	1.200	900
1999-2000	23	9.188	182.000	450	350
TOTAL		409.424		6.897	5.200

Sources: PASP annual reports

Table n° 6 : Financial output of some rural wood market : year 2000

Locality	Nbre of stères (=1 m ³)		Total money cashied F.CFA	Parts of SLG on the tax	Total revenue generated
	ORWM	CRWM			
Say	36 535	17 216	94 000 000	6 394 343	100 394 343
Kollo	12 745	6 969	34 499 000	2 3/82 323	36 881 823
Boboye	1 344		2 352 000	135 510	2 487 510
Madarounfa		19 065	33 363 750	3 002 785	36 366 535
Gouré	3 749		6 560 750	377 964	6 938 714
Magaria	86		150 000	8 614	159 114
Mirriah	531	572	1 930 250	143 668	2 073 918
Filingué	54 990	49 782	5 215 000	469 350	5 684 350
Total	101 792		178 071 950	12 914 557	190 986 307

Source: indicateur n°11, juin 2001 : Bulletin semestriel d'information au service de la Stratégie « Energie Domestique ».

Nb: ORWM = Oriented rural wood markets
CRWM = Controlled rural wood markets

Table n°7 : Different wood lots in Niamey city

Year	Area planted	Dominant Species	Name of the site
1986	2.11	Eucalyptus	Kaoura kano I
1987	2.70	Neem	Hopital Lazaret
1988	1.44	Neem	Ecole K. kano I
1989	9.3	Neem	Route Ouallam
1990	5.1	Neem	Koara kano II
1991	6.9	Indigenous	Station Deizebon
1992	12	Neem/ Indigenous	Bosquet des Nations
1993	5.25	Neem/Eucalyptus	Bois de l'Unité
1994	2.25	various	Bois de la Jeuness
TOTAL	47.05		

Abdoulaye Beidou (1997) : Quelle foresterie pour les centres urbains, Mémoire de fin d'études IPDR Kollo. P.32

Table n° 8: Forest species commonly encountered in Niamey Town - NIGER

	A. indica	E. camaldul	C. siamea	T. mentaly	P. juliflora	G. arborea	A. lebbeck	L. leucocepa l	M. Oleofera	Mg. Indica	Ornament als	TOTAL
Cultural centers	1 488	360	76	212								2 136
Banks/Insurances	22			106	46		24					198
Hotels/Restaur.	301	165		63								529
Health centers	308	33		67								408
Schools/ training	4 334	2 345	425	353		165						7 622
Ministries	258			38						20		316
Others offices	129	82					82			43		336
Public gardens	2	2		138	1			1	1	8	17	170
Ambassy/Consulat	132	79								39		250
Institution/Research	199	274	23	32		36						564
Total	7 173	3 240	524	1 009	47	201	106	1	1	110	17	12 529

Sources : Yacouba H. El hadji (1999) : exotic woody species of in Niamey Town (NIGER)

TREES OUTSIDE FOREST IN BRAZIL – A RENEWABLE RESOURCE WHICH CAN BE NEGLECTED?

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INTRODUCTION

According to FAO (Kleinn, 2000) trees on land not defined as forest and other wooded land (so-called trees outside forest, TOF) include:

- trees on land that fulfils the requirements of forest and other wooded land except that the area is less than 0.5 ha;
- trees able to reach a height of at least 5 m at maturity in situ where the stocking level is below 5 percent;
- trees not able to reach a height of 5 m at maturity in situ where the stocking level is below 20 percent;
- scattered trees in permanent meadows and pastures;
- permanent tree crops such as fruit trees and coconuts;
- trees in parks and gardens, around buildings and in lines along streets, roads, railways, rivers, streams and canals;
- trees in shelterbelts of less than 20 m width and 0.5 ha area.

TOF in Brazil occur mainly as trees within agroforestry systems, trees and parks in urban areas, fruit tree plantations or orchards and scattered trees and forest patches in transition zones as e.g. between dense forests and open savannas or swamps. In the following a TOF classification for Brazil will be outlined. Institutions which are involved in the development of TOF systems in Brazil are shown in the appendix (Table 5).

TOF CLASSIFICATION FOR BRAZIL

Trees within agroforestry systems (Clement, 1990, Dubois, 1996, Harwood, 1996)

The tree component in agroforestry systems in Brazil occurs in the form of live hedges (including windbreaks), alley cropping, (agro)silvopastoral systems, agroforests and shading elements for perennial crops. Within the sequential systems shifting cultivation and multistrata systems with perennial crops prevail.

In North Brazil indigenous tribes and traditional forest dwellers utilise a variety of domesticated palms and other (indigenous) fruit trees (so-called multipurpose trees, MPTs) in shifting cultivation and multistrata systems (home gardens). For these people gathering forest products is an important component in the agricultural cycle. E.g. babassu (*Orbignya martiana*) palm kernels are gathered during the agricultural slack period by tenant farmers with few possibilities for earning cash income. A variety of fruit tree species like the pejibaye palm (*Bactris gasipaes* H.B.K.) are domesticated (i.e. managed) by local tribes within agroforestry systems. These trees in general are planted on fallows. After rotation to other swidden plots the Indians return to the older plots to gather the fruit. Domestication has led to new varieties and clones of *Bactris* spp., pineapple and rubber and the extension of some valuable species like the Brazil nut tree. A great number of other tree species serve as collection trees without further harvest. Other well-studied examples of agroforestry systems

with native tree species are the systems of the Japanese who immigrated in the 1920s with the cultivation of black pepper together with trees. Due to phytopathological problems of pepper the systems underwent a diversification with other annuals but also trees.

Special attention must be given to the traditional system to produce cocoa in South Bahia where small landholders maintain shading trees to produce cocoa, dendeé and other crops and the culture of *Acacia* with annual crops in Rio Grande do Sul.

Some important systems with their regional relevance are described in Table 1:

Table 1: Agroforestry systems according to their regional occurrence.

Region (federal states)	Type of system	Tree species
South (Rio Grande do Sul, Santa Catarina, Paraná)	silvopastoral and agrosilvopastoral systems, "faxinal" (native tree species with pasture),	<i>Acacia mearnsii</i> , <i>Mimosa scabrella</i> , <i>Ilex paraguayensis</i> (erva-mate), <i>Araucaria angustifolia</i> (Brazilian pine) and other native tree species (e.g. <i>Euterpe edulis</i>),
Centre-East (e.g. Minas Gerais, São Paulo)	live hedges in vineyards alley cropping	<i>Platanus</i> spp.
Northeast (e.g. Bahia)	traditional cocoa system with shading trees, dendeé culture	<i>Eucalyptus</i> spp., <i>Pinus</i> spp.
North (e.g. Amazônia, Pará, Acre, Rondônia)	multistrata systems, shifting cultivation, alley cropping	<i>Cordia alliodora</i> , <i>Prosopis</i> spp., <i>Leucaena</i> spp., palms
Centre-West (e.g. Mato Grosso)	multistrata systems, shifting cultivation, silvopastoral systems	various native species (<i>Cordia</i> spp., <i>Tabebuia</i> spp., <i>Swietenia</i> spp., <i>Hevea brasiliensis</i>)
		various native species (see above), <i>Tectona grandis</i>

Trees and parks in urban areas (Veras, 1986, Milano, 1988, 1990, Kuchelmeister & Braatz, 1993, Kuchelmeister, 2000, Pastuk, 1999)

Urban forestry in Brazilian cities means the preservation and management of green areas and street arborisation. In every Brazilian city there are some parks and squares. But often a coordinated development ("master plan") of the green area sector is lacking and spontaneous measures prevail. Nevertheless, in many cities (smaller ones as well as metropolises) an environmental legislation process has been established in the last two decades. In the following cities major urban forestry activities have been documented (see References): São Paulo (São Paulo), Rio de Janeiro (Rio de Janeiro), Recife (Pernambuco), Curitiba (Paraná) [see case study], Porto Alegre and Bento Gonçalves (Rio Grande do Sul). The situation of parks and trees in urban areas has been analysed quantitatively and qualitatively in detailed case studies (Curitiba [see case study]), Maringá, in Paraná or Petrolina in Pernambuco). In general the situation of green areas in Brazilian cities is crucial, because they are far away from the 12 m² of green area per inhabitant which is required by the U.N. (see positive exception of Curitiba with 52 m² or Maringá with 21 m²). The problem is less the maintenance of trees and parks in downtown areas than an uncoordinated to chaotic urbanisation process in the periphery of the big cities. This horizontal expansion is characterised by clandestine occupations of land which often is unsuitable for buildings. The

absence of a sound housing policy and tenural insecurity in most of these areas lead to a strong geographical segregation of residential areas which goes along with a social stratification, too. In most cases the basic infrastructure of housing, health or waste deposition can not be guaranteed. Thus, there is just as little a concern for environmental policy.

Some documented aspects of urban forestry in Brazil are listed below (Ferreira, 1992, Moraes de Jesus, 1984, Pereira Lima, 1990, Sanchotene, 1990): tree planting and environmental education (project "Um milhão de árvores", São Paulo), establishment and maintenance of alleys and parks (Curitiba, Porto Alegre), establishment of urban orchards (Recife), rearrangement or structuring of parking areas with trees (Porto Alegre), establishment of green belts around industrial areas to contain pollution effects (port of Tubarão, Vitória). A well-documented case study of urban forestry is the Community Forestation Project (Projeto Mutirão Reflorestamento) in city of Rio de Janeiro (Pastuk, 1999). On the hillsides of Rio many favelas were established uncoordinatedly due to population growth (rural migration) and an absence of housing policy. These vulnerable agglomerations frequently suffer from landslides due to exposed soils and a high surface run-off. Reforestation programmes on the slopes above those favela towns helped to diminish their vulnerability against soil erosion and landslides and to reduce the pressure against native forest remnants. In this project, which was supported by the Parks and Garden Foundation (Fundação de Parques e Jardins), a special consideration was given to active community participation within the forestation activities.

Fruit tree plantations or orchards (Mesquita, 1986, Fachinello et al., 1996, Manica, 1997)

Due to its extension from the tropics to temperate climates Brazil has privileged conditions for all kinds of fruit production, especially tropical fruits. In 1994 Brazil had 2.5 million ha of fruit tree plantations: 55 % of them were located in the tropics, 40 % in the subtropics and 5 % in the temperate zones of the south. An emphasis is laid on the cultivation of citrus fruits (São Paulo), apple (Santa Catarina, highlands) but also on many tropical fruits (valley of San Francisco, valleys of smaller rivers in South Brazil and the coastal region). Fruit bearing trees play an important role in the Amazonian region where forest dwellers and indigenous people domesticated a lot of MPTs. Moreover, fruit trees are a very important component within the arborisation of urban areas (see example of urban orchard in the city of Recife).

The types of stands where fruit trees occur are multistrata and multispecies home gardens, monospecific industrial orchards, urban orchards or street trees and experimental stands (plots).

Scattered trees and forest patches in transition zones (examples) (Furley et al., 1992, Schelhas & Greenberg, 1996)

A large transition zone between dense forest formations and savannas has to be considered as a considerable area of TOF in Brazil, which has yet not been assessed systematically. Investigations on trees and forest fragments have been done in the following transition zones:

- 1) transition zone between close semi-deciduous forests (cerradão) and
 - a) Cerrado (open savanna with sparse trees or scrubs) on the entire border between the seasonal and humid tropics in Brazil [Mato Grosso, Goiás, DF, Tocantins, Pará, Maranhão, Piauí]. As a general rule one can say that the less fertile the soils are the poorer the conditions are for closed forests of the cerradão type. An important multiple-use tree species in the Brazilian Cerrado is *Caryocar brasiliense*;

b) wetland (wet flooded savanna in the Pantanal, Mato Grosso) with forest patches (islands) on elevated ground like termite mounds (e.g. forests with *Tabebuia impetiginosa*, *Attalea* palms);

c) Chaco (Argentine and Paraguayan thorn savanna) with *Shinopsis balansae* parklands (quebrachal) and other more or less chaquienian scrub formations.

2) transition zone between (close) Amazonian forests and

a) Amazonian hydrologic savannas as e.g. in Roráima (Maracá Island);

b) agricultural areas such as in Rondônia. The colonisation of Rondônia led to a strong fragmentation of forests. These forest patches and trees are retained by the farmers for self-sufficiency as well as for purposes of amenity and legacy.

QUANTITATIVE ASPECTS OF TOF IN BRAZIL

Data on land cover and use is summarised in different international databases. The World Resources Institute (see above) compiled data about forest cover, land area and use on the base of FAOSTAT Statistics (WRI, 2000).

The most important national database in Brazil is IBGE (Brazilian Institute of Geography and Statistics). The IBGE survey in the area of agriculture/land use ("Censo agropecuário", IBGE, 2000) does not account for TOF explicitly. As land uses only forests (native and planted), agricultural land (permanent and temporary) and different categories of degraded and unproductive land are distinguished. One type of information, which is accessible, is the tree number obtained by different types of producers, different landowner sizes or land use forms. In Brazil no other systematic assessment on TOF (forest inventory) has been made until now, neither on a national nor on a regional level.

The available data for the above described TOF systems is summarised in Table 2 (note: total area of Brazilian territory = 845652000 ha, with a percentage of 65.2 of forested land).

Table 2: Accessible quantitative information about TOF in Brazil.

TOF system	Area [ha]	[%] of Brazilian territory	[%] of Brazilian forested area	Source
Trees within agroforestry systems				IBGE (2000)*
Fruit tree plantations or orchards	2500000	0.3	0.4	Fachinello et al. (1996)
Trees and parks in urban areas	case study Curitiba, see detailed study			Secretaria do Meio Ambiente (2000)
Scattered trees and forest patches in transition zones	135418430	16.0	23.6	UNEP/WCMC (2000): Brazil Statistics

* IBGE provides data of the agricultural survey 1996 based on more than 4.8 million properties in Brazil. There the number of trees within different land uses is given (e.g. 24347921 *Acacia mearnsii* on pastureland within Brazil, for more see IBGE website in references).

It must be stated that the estimates of Brazilians current forest cover differ significantly, depending on the source. FAO's estimate encompasses 573000000 ha whereas e.g. UNEP-WCMC on the basis of the US Geological Surveys (USGS) Earth Resources Observation

System (EROS) only found 443562180 ha. Therefore, also the TOF data available are very uncertain.

CASE STUDY: THE SITUATION OF URBAN FORESTRY IN THE CITY OF CURITIBA (SECRETARIA DO MEIO AMBIENTE, 2000)

Curitiba, the capital of the Brazilian federal state of Paraná, is the eighth largest city of Brazil with 2.42 million inhabitants (greater Curitiba) and one of the regional metropolises of Brazil. The city is located on the first highland plateau of Paraná, at an altitude of 905 m asl. Towards the E the nearly 2000 m high coastal mountain range delimits the highlands from the coastal zone (distance 80 km). Further urban growth and expansion still is possible towards the N, W and S. The climate is subtropical humid with the occurrence of several frost nights in winter. The natural (forest) vegetation of the highlands in the surroundings of Curitiba is the tropical moist mixed forest ("floresta ombrófila mista") with predominance of *Araucaria angustifolia* in the upper storey and a variety of broad-leaved trees in the lower storey. Today, however, only small fragments of mostly exploited Araucarian forests remain. The natural vegetation of the coastal range at the E of Curitiba metropolitan area is a dense tropical moist (cloud) forest, the so-called "Mata Atlântica". From 61 million ha of coastal rain forest in Brazil until today only 3 % survive (FAO, 1993). A significant fragment of this forest type near Curitiba is preserved as an UNESCO biosphere reservation.

In the 1960s and 1970s modernisation in agriculture in south and south-eastern Brazil (including Paraná state) but also severe dry periods in other regions of Brazil (especially Northeast) with a subsequent displacement of small family farmers and sharecroppers led to enormous immigrant fluxes to the main urban centres, such as São Paulo and Curitiba. During those decades Curitiba experienced a demographic expansion of up to 5.7 % annually. The implementation of a progressive environmental policy in Curitiba dates back to that time. The demand for recreation and leisure areas increased rapidly. Parallel with population growth and urban expansion access roads to residential areas received linear green zones ("jardins ambientais"). Cycleways with "green" components were built along railway routes. Polluted areas with disordered development were treated and transformed into "green" areas. The city's authorities began to create parks and preserve remaining gallery forests to improve natural draining. Parks and groves were named according to the different immigration ethnics (German grove, pope grove, etc.) to support cultural identification. The arborisation of the city's streets was intensified with the planting of 70000 trees (annual mean number of trees planted since then: 3000). Moreover, programmes of environmental education were launched to accompany the shaping of an environmentally friendly attitude among the citizens.

Recently the metropolitan area is experiencing another accelerated growth process due to intensified industrialisation (e.g. the establishment of international firms such as Renault and Volkswagen). An interesting current urbanisation phenomenon of many Brazilian metropolises can be observed, too. Especially former suburbs and not necessarily the capitals themselves profit from industrial and population growth. This is the case with São José dos Pinhais, 40 km south to Curitiba, where the establishment of a Volkswagen plant and the new airport has led to an exorbitant growth and land consumption.

Despite all problems today, Curitiba is known beyond the national border for its policy in favour of a well-ordered urban development, sophisticated public transportation system and environmental conservation, attributes, which gave Curitiba the character of a modern model city in Latin America. Already during the last 30 years Curitiba has focused on its urban

planning. A master plan for an orderly urban development was implemented beginning with J. Lerner's administration in 1971. The development of the master plan was accompanied by the IPPUC ("Research and Urban Planning Institute of Curitiba") and permanent discussions throughout society ("Tomorrow's Curitiba" seminars). Today the city moves forward to extend its solutions to the whole metropolitan area. The special "Municipal Secretary for Metropolitan Affairs" links Curitiba to the governments of 24 surrounding municipalities. Recently the city's administration launched 24 inter-divisional "core ideas projects" for the metropolitan area such as "zoning and land use" with time tables for execution.

In 1973 the former IBDF (today IBAMA) transferred the legislation responsibility for Curitiba's green areas to the city authority. Green areas were defined to be native forests with the purpose to protect water, soil, fauna and scenic assets, thus excluding plantations of fast-growing exotic species like *Eucalyptus* and *Pinus* (law 6819 of 1986, see Table 6). In the following the former city's park directory became directly connected to the mayor's office. In 1991 the environmental policy law was created which established general measures of environmental protection, conservation and melioration within the capital. After several organisational changes, the Environmental Secretary of Curitiba is now in charge of the supervision and monitoring of parks, isolated trees and conservation areas as well as the arborisation of streets. 93 areas of tree vegetation, which belonged to former permanent preservation areas, were mapped and registered in the year 1974. In 1998 already 1100 forests of permanent preservation existed within Curitiba's special green area sector (forests of permanent preservation are native forest remnants on real estates within the municipality). As a special category of the green area sector preservation areas ("Unidades de conservação e lazer") like parks, groves or squares were delimited (for a summary of these areas see Table 3). The specially protected areas as well as the forests of permanent preservation underlie the local municipal norms. Today Curitiba has about 52 m² of green area per capita which is under the municipality's control and monitoring. Recent surveys even indicate an increasing trend in green area, but with strong variations throughout the different town districts (e.g. the city centre only accounts for 5 m² per capita). The UN Health Organisation's recommendation is 12 m² of green area per capita (Secretaria do Meio Ambiente, 2000). The legislation development relating to TOF systems in Curitiba is documented in Table 6.

Table 3: Type, number and size of conservation and leisure units in the city of Curitiba (source: Secretaria do Meio Ambiente, 2000).

Types of green area	Number	Area [m ²]
Parks ¹	14	18407873
Forests (groves, "bosques")	12	612295
Squares	351	2017789
Gardens ("jardinetes")	289	303839
Places ("largos")	52	58571
Environmental gardens ("jardins ambientais")	6	51100
Sport centres	2	64100
Environmental cores	11	6676
Animation axes	14	417118
Total	751	21939361

¹ within the park area "Parque Iguaçu" is considered to be the largest urban park in Brazil with a total area of 8264316 m².

The main goals of Curitiba's parks and green area policy are to create compensation areas in the "urban ecosystem". Often the parks and groves are connected with leisure areas, thus supporting environmental education of the population. In the responsible authority's philosophy *green* areas have to play a pre-eminent role in the urban environment to further guarantee a sound urban development. Another goal is the preservation of typical vegetation (forest) formations of the region. One of these parks, which turned out to be the symbol of Curitiba, is the new botanical garden with the famous greenhouse, which was inaugurated in 1991. Completed with a botanical museum, this park still shows one of the few remaining native forest fragments with *Araucaria angustifolia* within the urban area. Another example is the "German grove" with a secondary forest mainly of deciduous trees. In the south of Curitiba a new park recently was dedicated to Brazil's 500th anniversary. Some more areas will be delimited soon, especially in the periphery.

According to the current regulations in Curitiba the felling of isolated trees requires a permit from the Environmental Secretary (see so-called "árvores imunes de corte", Table 4). If cutting permission is obtained two trees of recommended species (in the case of *Araucaria angustifolia* four) have to be planted or donated to the city by the landowner. The trees and forests in the city's special sector of green areas no longer lose their destination of being forest. That means that in the case of forest degradation or destruction the forest has to be fully restored. Soil occupation in the city's real estates is regulated in detail considering the size and vegetation cover of the real estate. Furthermore, the landowners in the special sector of green areas are encouraged to preserve forest fragments with a reduction or suspension of property tax proportional to the forest cover registered on their land. The city also benefits from a state law (so-called "ICMS ecológico"), which allows the city to keep 5 % of value added tax from the state if it manages conservation areas or forests with sources. Thus Curitiba gets 300000 R\$ (1US\$ \approx 1,85 R\$, October 2000) weekly which can be spent on ecological purposes. A special fund (Municipal Environmental Fund) was created to allocate the money from surcharges, donations and other sources in order to establish environmental priorities. Currently Curitiba is discussing a further extension of environmental regulations within a municipal forest code.

There are few detailed studies assessing the situation of green areas and street trees in Curitiba (Milano, 1984, Roderjan & Barddal, 1998). Based on a systematic inventory street trees were sampled and identified including crown and root characteristics, as well as diseases and other damages (Table 7). In total 4382 trees were investigated. Of the 93 species, which could be found in the city's streets, 18 species accounted for 92 % of the population. The two most abundant species (*Lagerstroemia indica* and *Ligustrum lucidum*) account for 39 % of the population, indicating a great risk because *Lagerstroemia* is highly susceptible to fungi. One third of the trees were damaged. 3 % of the trees caused damages on the streets due to superficial root systems. It could be observed that many of the trees had already reached electricity lines, which in most cases provoked inadequate severe tree pruning. The spacing between the trees in general was found to be sufficient. To summarise the city's arborisation was considered still to be good.

Today a significant part of the population is involved in Curitiba's environmental programmes. There are several activities in the field of environmental education like "Olho d'Água" where municipal students carry out survey programmes about river quality or "Câmbio Verde" where recyclable trash is exchanged for food or teaching material. For 4 kg of trash one gets 1 kg of fruit. In a programme conducted since 1989 the Municipal Health Secretary supports the production of medicinal plants which are freely distributed to local

health stations. In a project called "Cesta Metropolitana" fruits are sold 30 % below market price especially for poor people from peri-urban areas. There are no explicit projects in the fields of urban agriculture in Curitiba but small producers of the metropolitan area have the right to sell their products on special markets without middlemen. Curitiba's environmental project with the most success concerning participation of the local people is the communal planting project ("Plantios Comunitários"). Supported by the Environmental Education Department planting native (fruit) trees is carried out together with the local people. Once suitable areas are localised, the Department gets into contact with local representatives and involves them in the planning process. Areas for planting always are public areas, mostly threatened by erosion or inundation like steep slopes or riparian zones. The local people are also provided with knowledge about the tree or shrub species. The above described activities are not restricted to the city centre but have an emphasis especially on the periphery of the urban agglomeration.

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Appendix

Table 4: List of tree species which can not be cut ("árvores imunes de corte") in Curitiba.

Scientific name	Popular name
<i>Chorisia speciosa</i>	paineira
<i>Populus nigra</i>	poplar
<i>Castanea vesca</i>	chestnut
<i>Eucalyptus</i> spp.	eucalyptus
<i>Araucaria angustifolia</i>	Brazilian pine
<i>Araucaria bedwillyi</i>	
<i>Tipuana tipu</i>	tipuana
<i>Schizolobium parahybum</i>	guapuruvu
<i>Olea europea</i>	olive tree
<i>Carya illioensis</i>	nogueira

Table 5: List of institutions and agencies which promote the management and utilisation of TOF systems.

Name of institution	Character	Seat
Brazilian Agroforestry Network	NGO	Rio de Janeiro, RJ, Brazil
Executive Commission for the Development of Cacao (CEPLAC)	governmental	Ilhéus, BA, Brazil
Agroforestry Formation Centre (CFA-Jatobá)	NGO	Pirai-do-Norte, BA, Brazil
International Centre of Tropical Agriculture (CIAT)	governmental	Cali, Colombia
State Secretaries of Agriculture (EMATER)	governmental	different federal states
EMBRAPA ⁺ /CPAA	governmental	Manáus, AM, Brazil
EMBRAPA/CPAF	governmental	Rio Branco, AC, Brazil
EMBRAPA/CPATU	governmental	Belém, PA, Brazil
EMBRAPA-Cerrados	governmental	Planaltina, DF, Brazil
EMBRAPA-Florestas	governmental	Colombo, PR, Brazil
Brazilian Institute for Environment and Renewable Natural Resources (IBAMA)	governmental	different federal states
International Council for Research in Agroforestry (ICRAF)	governmental	Nairobi, Kenya
National Institute for Research in the Amazon (INPA)	governmental	Manáus, AM, Brazil
Brazilian Society of Urban Forestry (SBAU)	NGO	Rio de Janeiro, RJ, Brazil
Terra viva	NGO	Itamaraju, BA, Brazil

⁺EMBRAPA=Brazilian National Council for Agricultural Research

Table 6: Important laws and decrees of the environmental legislation in Curitiba referring to urban planning and TOF.

Name of law, decree	Subject
Lei ⁺ 4557/73	protection and conservation of trees
Lei 5234/75	zoning of land use
Decreto ⁺ 400/76	preservation of riparian zones
Lei 6819/86	formation and preservation of green areas, tree compensation planting
Lei 7833/91	environmental policy
Decreto 471/88	establishment of municipal parks
Lei 8353/93 and Decreto 782/95	parameters for occupation of real estates, criteria for tree cutting
Municipal Forest Code 1998 (not yet passed)	collection of all environmental relevant legislation

The last two figures of the number in the first column indicate the year when the law passed (e.g. /73=1973).

+ lei = law; decreto = decree

Table 7: List of TOF vegetal species found in the streets of Curitiba (according to Roderjan & Barddal, 1998).

Scientific name	Family	Native (n) or exotic (e)
<i>Acer negundo</i> Linn.	Aceraceae	e
<i>Aleurites fordii</i> Helmsl.	Euphorbiaceae	e
<i>Anadenanthera colubrina</i> (Vell.) Brenan	Mimosaceae	n
<i>Aspidosperma olivaceum</i> Muell. Arg.	Apocynaceae	n
<i>Balfouodendron riedelianum</i> Engler	Rutaceae	n
<i>Caesalpina leiostachya</i> (Benth.) Ducke	Caesalpinaceae	n
<i>Caesalpina peltophoroides</i> Benth.	Caesalpinaceae	n
<i>Cassia leptophylla</i> Vog.	Caesalpinaceae	n
<i>Chorisia speciosa</i> St. Hil.	Bombacaceae	n
<i>Citharexylum myrianthum</i> Cham.	Verbenaceae	n
<i>Clethra scabra</i> Loisel.	Clethraceae	n
<i>Cybistax antisphilitica</i> Mart.	Bigoniaceae	n
<i>Erythrina falcata</i> Benth.	Fabaceae	n
<i>Eugenia uniflora</i> Berg.	Myrtaceae	n
<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	e
<i>Holocalyx balansae</i> Miq.	Caesalpinaceae	n
<i>Jacaranda mimosaeifolia</i> D. Don	Bigoniaceae	e
<i>Jacaranda puberula</i> Cham.	Bigoniaceae	n
<i>Koelreuteria paniculata</i> Laxm.	Sapindaceae	e
<i>Lafoensia pacari</i> St. Hil.	Lythraceae	n
<i>Lagerstroemia indica</i> Linn.	Lythraceae	e
<i>Leucaena leucocephala</i> (Lam.) de Wit	Mimosaceae	e
<i>Ligustrum lucidum</i> Ait.	Oleaceae	e
<i>Magnolia grandiflora</i> Linn.	Magnoliaceae	e
<i>Melia azedarach</i> Blanco	Meliaceae	e
<i>Michelia champaca</i> Linn.	Magnoliaceae	e
<i>Parapiptadenia rigida</i> (Benth.) Brenan	Mimosaceae	n
<i>Peltophorum dubium</i> Taub.	Caesalpinaceae	n
<i>Pittosporum undulatum</i> Guill.	Pittosporaceae	e
<i>Populus nigra</i> Linn.	Salicaceae	e
<i>Robinia pseudoacacia</i> Linn.	Caesalpinaceae	e
<i>Salix babylonica</i> Linn.	Salicaceae	e
<i>Senna macranthera</i> (DC. Ex Coll.) Irwin & Barn.	Caesalpinaceae	n
<i>Senna multijuga</i> (L.C. Richard) Irwin & Barn.	Caesalpinaceae	n
<i>Syagrus romanzoffiana</i> (Cham.) Glassm.	Arecaceae	n
<i>Tabebuia alba</i> (Cham.) Sandwith	Bigoniaceae	n
<i>Tabebuia chrysotricha</i> (Mart. Ex DC.) Stand.	Bigoniaceae	n
<i>Tabebuia heptaphylla</i> (Vell.) Toledo	Bigoniaceae	n
<i>Tibouchina pulchra</i> Cogn.	Melastomaceae	n
<i>Tibouchina sellowiana</i> Cogn.	Melastomaceae	n
<i>Tipuana tipu</i> (Benth.) Kuntze	Bigoniaceae	e
<i>Vochysia bifalcata</i> Warm.	Vochysiaceae	n

bold print: the two most abundant species