



Thesis idea catalogue

Agroforestry

Ethnobotany

Forest restoration

Working Group for Tropical Forests

Section for Forest, Nature and Biomass

Department of Geoscience and Natural Resource Management (IGN)

University of Copenhagen

Introduction

Concluding your MSc education you will be doing a thesis study, which usually implies a field work of 2-3 months and subsequent analysis and write-up. We are a small group of researchers and development experts, with a long experience in the tropics, who may supervise thesis work within our field of expertise. If you consider doing a thesis in relation to tropical forest, the subsequent list may give you some inspiration. The proposed topics have arisen from looking at 'gaps' of research documentation and what is possible to do within a limited period of field work in connection with a thesis. The list is not exclusive. The catalogue is organized under three main topics: Agroforestry, Ethnobotany and Tropical Forest Restoration, which links to courses where staff from the working group are mainly involved.

I. Agroforestry

Background

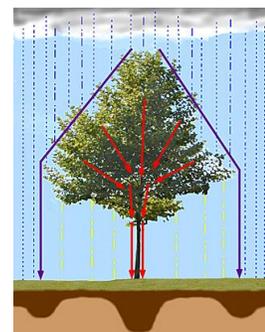
Agroforestry is agriculture with a large tree component. The term is usually used in connection with complex tropical systems, from dry to humid climates, and from lowland to highland, but AF also occur in temperate areas e.g. as permaculture and shelterbelts. Agroforestry systems are often complex with many species and types of interactions, which develop as trees grow. Thesis research must necessarily focus on short term interactions, conditions, individual species and management factors. Comparative analysis of AF contra non-AF systems may be implemented for most research areas.

Relevant topics

Thesis topics could be carried out within following key areas

1. Microclimate and water relations in agroforestry

Trees have two opposite effects in water balance: On the one side their shade reduces temperature and thus evaporation under the canopy. On the other hand trees also intercept and consume water and thereby reduce availability of water for plants growing beneath them e.g. crops. The phenomenon is particularly important in dry and seasonal dry climates where the balance determines the overall ad- or disadvantage of intercropping, which may shift during the seasons.



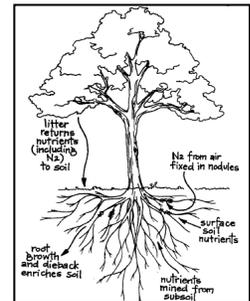
Examples of thesis topics:

- Variation of potential evapotranspiration of trees and crops under different conditions
- Measuring interception, stem flow and dripping off during rain, following water content in soil under and outside canopy shades
- Examine the growth of plants under and outside canopy shade zones in order to examine the impact of trees on water balance.

Potential supervisors: Anders Ræbild, Lars Schmidt

2. Soil and nutrients

Trees have impact on soil in several ways e.g. extracting nutrients from deep layers, through nitrogen fixation and extraction of phosphorous via mycorrhiza. In addition trees in dry areas and during dry seasons catch wind borne dust, which may contribute to nutrient input to the system. Opposite, trees also consume nutrients and as such compete with crops. The overall contribution of trees to the nutrient balance varies with species, environmental conditions and management.



Examples of thesis topics:

- Impact of trees on particular nutrient pools (N, P) related to species, sites and conditions
- Roles of trees in catching wind-borne sediments and investigate nutrient input via dust.

Potential supervisors: Anders Ræbild, Lars Schmidt

3. Animals in Agroforestry

Domestic animals are part of most subsistence systems including agroforestry systems. Domestic animals are primarily for food and include both large (cattle, pigs, goats, camels) and small (rabbits, poultry) species. Tree products, both leaves and fruits, are used as fodder for animals. Animal food is both waste products from food production and cultivated fodder crops. In particular legumes are widely used as supplementary protein supply for cattle. Tree foliage can make up a high quality fodder when most of the vegetation is dry and of poor nutrient value. However, some tree fodders have poor digestibility (e.g. high content of tannin or alkaloids).



Examples of thesis topics:

- Fodder value of different types of tree products during different time of the year and how trees can be managed to produce optimal fodder for domestic animals.
- Quality and palatability of fodder plants through study of domestic animals' preference for various fodder crops including both grass and trees, for the latter break down in fruits and leaves.
- Sources of fodder through the season including 'cut and carry system' and post-harvest grazing
- Quality and storage of tree fodder

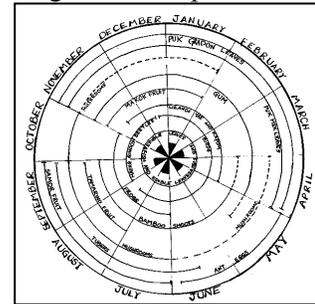
Potential supervisors: Hanne Hansen, Lars Schmidt, Jens-Peter Barnekow-Lillesø

4. Agroforestry systems for seasonal food security

Small subsistence units are dependent on a current flow of harvestable products throughout the year. In seasonal climates, cropping patterns are adapted to the seasonality (e.g. moist and dry season crops) and crops are stored for consumption during non-productive seasons. Trees often make up an extended production season because several trees bear fruits when no fresh production is available, and green foliage may be harvested where herbs are already withered. Trees' roles in mitigating food crises increase during events of periodic droughts and crop failure.

Some thesis options:

- Self sufficiency, crop season extension and other ways to cope with seasonality to secure a stable food supply throughout the year.
- Local diet adaptations including products from trees during 'hunger seasons'
- Quantitative and qualitative (nutritional value, taste etc.) food security.
- Storage of food e.g. through drying



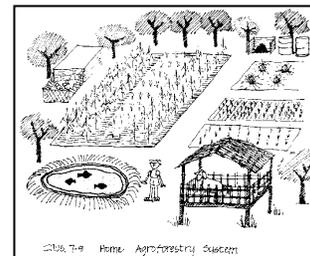
Potential supervisors: Lars Schmidt

5. Impact of trees on crop productivity

It is generally observed that intercropping systems imply a current competition between trees and crops. The character of competition and complementation is, however much species- and environment dependent. Tree – crop interactions have been one of the 'traditional' research areas for agroforestry. However, the number of variables is very large both in terms of particular species combinations and in terms of environmental variables.

Some thesis options:

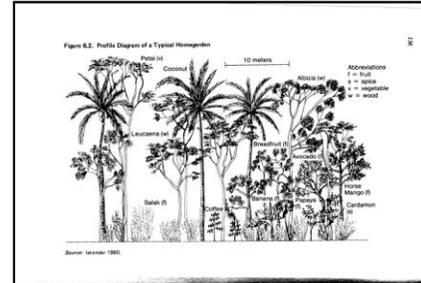
- Productivity of particular crop species as mono-crop and in combination with particular tree species. Suitable especially for crops often grown as mono-crops e.g. tea, coffee, cereals
- Tree allelopathy, - suppressing growth of plants by root exudates.



Potential supervisors: Anders Ræbild, Lars Schmidt

6. Spatial distribution of species in complex home gardens

Home-gardens are among the most complex, diverse and most productive AF systems in the humid tropics. Diversity is maintained both for food and market security. Close studies of AF systems will usually show that species are distributed with careful considerations to site variation (e.g. moist and dry sites), and spatial complementation.



Some thesis options:

- Species composition in selected homegardens
- Harvested output from home-gardens
- Home garden design, - correlation between biophysical parameters (microclimate and soil) and species distribution.

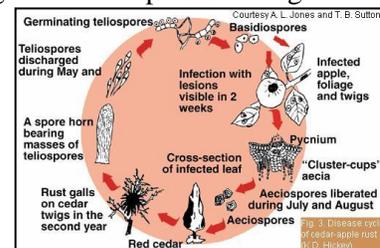
Potential supervisors: Anders Ræbild, Lars Schmidt, Søren Moestrup

7. Pest management in agroforestry

Biological control is one of the key elements in integrated pest management in tropical farming systems. Trees can be intermediate hosts or refuges of pest and diseases, but may also play the same role for enemies of pest and pathogens. Except from these general considerations, the role of trees for pest management is largely unknown.

Some thesis options:

- Pest and disease interaction (life cycles) between crops and trees; shared pest and pathogens (e.g. fungi).
- Trees as reservoir of crop pest, e.g. bruchid beetles on legume trees infesting pulses (legume crops)
- Trees as a reservoir of pest enemies e.g. insect eating birds



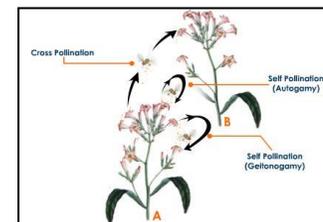
Potential supervisors: Lars Schmidt

8. Tree fruit production: Pollination limited fruit production in AF systems

Biologically, fruit production is closely linked to seed development. Except from parthenogenesis and apocarpny there will be no fruit development unless species have been successfully pollinated and seeds develop. Pollination limited fruit production may occur where pollination is inadequate e.g. large distance between intercrossing parents or shortage of suitable pollinators. Cloned fruit trees derived from same parent tree may fail fruiting because of inbreeding problems. In dioecious species shortage of males can lead to poor fruiting.

Some thesis options:

- Flower abortion after self and out-breeding based on controlled pollination
- Pollination and pollinators of fruit trees



Potential supervisors: Anders Ræbild, Lars Schmidt

9. Tree and land tenure systems, outgrowing

In many tropical areas tree tenure / user right came before land tenure. From being a free available public resource, individuals have, through customs turn tree custodies harvesting products (e.g. fruits, nuts and resin) and protecting ‘their’ trees others. This traditional tenure has often carried over even when land was later cultivated, i.e. those now owning the land may not own or have the disposal right over the trees growing on them. As trees eventually age or die from (often deliberate imposed) damage, land owners may permit outsiders to plant trees on their land for a fee. This outgrowing system, which is essentially a rental contract, is used for different types of trees.



Some thesis options:

- Local patterns of tree and land tenure systems, - who owns land and who owns trees
- Written and unwritten rules on tree and land use between shared parties
- Contractual outgrowing systems, how much and when are farmers paid for land lease for trees?

Potential supervisors: Anders Ræbild, Lars Schmidt, Søren Moestrup

10. Adoptability of AF, effect of national policy development in general economy, agricultural and forestry policy

Long rotation crops require long time horizon to be attractive for resource poor farmers. Insecure tree tenure, changing or in transparent land tenure systems, inheritance systems and gender issues can have strong influence on tree growing, both whether trees are grown at all and which species are grown. Agricultural policy typically focuses on annual crops, and policy is often influenced by the immediate market prices or short-term policy development.



Some thesis options:

- Consequences of well-defined economic policy / decrees / laws on tree planting in general and agroforestry systems in particular.
- Constraints and incentives for agroforestry adoptability

Potential supervisors: Anders Ræbild, Lars Schmidt, Søren Moestrup

II. Ethnobotany

Ethnobotany encompasses the interaction between people and plants. Ethnobotanical research has traditionally been carried out in societies with high dependency of wild plants, i.e. remote 'traditional' communities with access to wild plant resources. Thesis research may take point of departure in communities' broad use of plants, available plant resources (often forests), or specific plant groups (food plants, food additives, medicinal plants or rattans). Comparative studies of different community uses of plants e.g. in relation to economic development, access to plant resources and access to alternative products (e.g. medicine) are key research areas in Ethnobotany. Ethnobotanical research usually includes both community surveys (questionnaires / interviews) and botanical collections.

Relevant topics: Thesis topics could be carried out within following key areas

1. Fuelwood surveys

Fuelwood is the main energy source in most rural areas in the tropics. Fuelwood is typically collected from 'open' forest resources, which may be community land or have different ownership. Shortage of resources in terms of species and quantities may lead to change of energy use, both in terms of energy source and consumption.



Examples of thesis topics:

- Criteria for quality fuel wood, e.g. burning habit, smoking, energy, sparking, etc
- Adoption of energy consuming habits e.g. improved stoves, less hot meals, less hot baths
- Use of alternative fuels e.g. waste products
- Sustainable fuelwood consumption, e.g. from village forests or wasteland

Potential supervisors: Lars Schmidt, Søren Moestrup

2. Medicinal plants

Communities without access to modern medicine usually use plants collected from the wild. Knowledge of medicinal plants is often kept with local experts. Medicinal plants range from species used as preventive food additives, to specific treatments of specific suffering. Many plants contain are known to active compounds, while others are more speculative, and medicinal plants may also include 'superstition' plants

Examples of thesis topics:

- Plant groups used for specific suffering or diseases e.g. postpartum, infections, respiratory or digestive diseases.
- Local knowledge and broad sense community use of medicinal plants including local resources
- Development of medicinal plant use compared to prescriptive medicine from pharmacies. Incentives and disincentives for using alternative sources
- Development of access to medicinal plants e.g. as a result of changed access to resources
- Veterinary medicinal plants, - e.g. plants used to treat cows, pigs and horses



Potential supervisors: Lars Schmidt, Lars Graudal

3. Dependency and use of wild food plants

Wild fruits, roots and leaf vegetables may be used as a current, seasonal or occasional ('famine') food supply, generally of especially by poor people. Wild food may also occasionally be traded or bartered. Collection of wild food may be an all family affair, or may be undertaken only by women and children

Examples of thesis topics:

- Pattern of wild food collection e.g. who collects what, when and from there
- Role of wild food as food security. What do wild plants yield, - bulk, vitamins, proteins?



Potential supervisors: Lars Schmidt

4. Access to wild plant resources

Deforestation, conversion of land to different land use (agriculture, hydroelectric dams, urban areas etc) or protection (reserves, national parks) often impedes traditional use of wild plant resources. Pressure on resources may also simply exhaust resources and turn plant extinct.

Examples of thesis topics:

- Status of wild plant resources in accessible areas
- Collection impact on wild plant resources. Local rules or regulations on how, and how much to harvest. Promotion of wild resources through use
- Role of wild food as food security. What do wild plants yield, - bulk, vitamins, proteins?

Potential supervisors: Lars Schmidt

5. Domestication and cultivation of traditional wild plants

Reduced or impeded access to wild natural resources may encourage domestication of species traditionally harvested from the wild. Domestication may go through various 'stages' from natural management, planting or enrichment at 'wild' sites (typically forest) to actual cultivation on private land. Often several stages persist at the same time. During domestication selection of suitable 'types' typically takes place. '

Examples of thesis topics:

- Domestication process of particular plants including wild resource survey, semi- and full domesticated types.
- Use of 'wild' relatives of domesticated plants



Potential supervisors: Lars Schmidt

III. Tropical forest restoration

Tropical forest restoration refers to activities of restoring degraded, destroyed or vanished forest in tropical environments. Restoration may take point of departure on large landscape level or specific sites. The topic includes aspects from seed provision, plant propagation, establishment methods (planting, sowing, single trees or species mix, design), and development and management methods. Tropical forests are often complex and species and interactions changes as they grow. Short term thesis research may focus on species interactions e.g. plant communities, pollination or dispersal studies. Comparative studies of natural succession and managed restoration models can sometimes be made.

Relevant topics

Thesis topics could be carried out within following key areas

1. Natural succession and ANR

Natural recovery of disturbed area typically goes through a series of succession stages. Succession is influenced by e.g. dispersal of seeds which in turn is dependent on seed trees, distance and (often) natural dispersers. ANR aims at by-passing delays by actively introducing plants into an area.

Examples of thesis topics:

- Comparison of species composition after natural succession and ANR in plots with same degradation history.
- Natural regeneration, and its pre-conditions and limitations, of selected late successional species in disturbed forest
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Potential supervisors: Lars Schmidt, Jens-Peter Barnekow-Lillesø



2. Plant propagation

Introduction of plants for forest restoration usually goes through a stage of propagation by seed or cutting. Successful propagation is a pre-condition for 'free' species selection. Propagation obstacles include dormancy and recalcitrance for seed, and rooting and plagiotropism for cuttings.

Examples of thesis topics:

- Dormancy and pre-treatment of seed
- Germination, predation, root formation and survival of nursery raised plants compared to field sowing (direct sowing)
- Rooting ability for different gutting types
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Potential supervisors: Lars Schmidt, Søren Moestrup



3. Pollination and dispersal

Regeneration in natural forest consists of a complex network of animal pollinators and seed dispersers, which may have been heavily disturbed and in some cases even gone extinct in degraded forest. Poor or absent pollination may result in failure of seed setting or formation of inbred seed. Shortage of dispersal may result in all seed falling under mother trees where they are often destroyed by predators.

Examples of thesis topics:

- Pollination agents, behavior and efficiency of pollinators. Include both insect, bird and bat pollinated species.
- Mode of dispersal and distance for key tree species.
- Seed predation under mother trees compared to predation way from the trees

Potential supervisors: Lars Schmidt

Where to carry out the research

The location for your research will to a large extent be determined by your topic. It is practical if your research topic is related to the core area of your hosting institution, since you may take advantage of collected data and your host may be more interested in supporting you, if your data collection is complementary to their own research. Please observe that some education programmes require that you do your research in another country than your home country. The Working Group on Tropical Forests can sometimes help you identifying projects or NGOs who can 'host' you during your research.

Some contact institutions:

1. Indonesia: World Agroforestry Centre (ICRAF), Save the Orang Utang, Regional Forest Seed Centres (BPTHs), OWT (SE Sulawesi, E. Kalimantan), Birdlife International (Flores), Tropenbos International,
2. Cambodia, Conservation International, Agricultural Development Denmark Asia (ADDA)
3. East Africa: ICRAF, HQ Nairobi, sub-stations and projects in most neighbouring countries, Tanzania Tree Seed Centre,
4. Latin America: Verdens Skove (Bolivia, Costa Rica)
5. West Africa

Time, duration and preparation

A theses of 45 ICTS should take 9 months, all included. Start of applications for research permit should be done at least 6-8 months before the scheduled research; contacts and approval from host institutions should be in place before research permits can be applied for. A research permit is normally only given with a complete research description and approval from a local university counterpart and the host institution.

Permits and expenses

Most countries require a research permit, and working without is potentially a legal offence. The price varies from country to country.

You will normally be asked to pay a cost price for your stay including hiring of support staff (translator/ interpreter, driver, field assistance), when you stay with or are affiliated with a host institution / project. If you stay in a private house in a village you will also be expected to pay for stay.

Although prices are often low in developing countries compared to e.g. Denmark, be aware that 'fees' are often necessary to get things done,

Things to be aware of in field research:

1. Natural systems change and develop over long time. The picture you get through your research may be momentary. Consider how things would be before and after.
2. If you make interviews, be aware that you take people's time. Avoid time when people are busy (e.g. morning hours). Even with your most genuine interest and friendliness, some people may just find 'yet another researcher' annoying. Make sure you get introduced properly via village headman, head of influential NGO, party, church, mosque or whatever 'authority' is powerful in the area.
3. What people are doing is not always legal, and they may not be keen to tell you that they have illegally cleared forest, are cultivating on sloping land or collecting NTFP in protected forests. Do not turn interviews into inquiries or interrogations.
4. Bring things back: Remember to send a copy of your report and spend a few hundred Danish Kroner on print pictures; - rural areas are not as spoiled with pictures as the 'West'.
- 5.
- 6.