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DISTRIBUTION

Invasive woody species in the Monga Forest, East Usambara Mountains

Abstract

A study to assess the extent of invasive alien species *Maesopsis eminii*, *Clidemia hirta*, *Lantana camara* and *Rubus rosifolius* was conducted in the undisturbed Monga Forest of the Eastern Usambara mountains, Tanzania. Ten transects were aligned along the forest edge with 10 m distance zones to determine the presence or absence of the species in 2 m x 2 m quadrats for any of the plant species while a larger (4 m x 4 m) quadrat was used to record the presence of *Maesopsis* trees. ANOVA showed significant variation in the extent of invasiveness among the five species and across the zones. Greater frequency of occurrence of *Maesopsis eminii* and *Clidemia hirta* were observed at the edge of the forest than in the interior. *Lantana camara* and *Rubus rosifolius* were restricted to the edge of the forest. G^2 -tests revealed some associations between *Maesopsis* and *Clidemia* as well as *Lantana* and *Rubus rosifolius* although it could signify only suggest that required conditions for growth are similar. The results show that invasion is associated with forest disturbance, with the edge of the forest being the most comprehensively invaded.

Anthony A. Kimaro, Sokoine University of Agriculture, Tanzania

Luke Malembo, Forestry Research Institute of Malawi, Malawi

1998

Density variation of *Lantana camara* and *Clidemia hirta* with a forest profile perspective, across the forest edge in Amani Nature Reserve

Abstract

This study was carried out in Amani Nature Reserve, and focused on the variation in densities of *Clidemia hirta* and *Lantana camara*, and their relationships to canopy openness and distance from disturbed and undisturbed forest edges. A forest profile was constructed to summarise forest edge ecology in Amani. *C. hirta* was found to show no clear relationship with either canopy openness or distance from forest edge and *L. camara* correlated more strongly with distance from forest edge. The relationships were attributed to light demand. Further study should focus on other possible causes of the relationships presented.

Frances Hepworth, University of Cambridge, UK

David Mushabe, Makerere University, Uganda

2002

**Life history of *Maesopsis eminii*:
Architecture and behavioural ecology in the forest**

Abstract

In this study we focus on the growth patterns of *Maesopsis eminii*, an invasive tree species of the East Usambara Mountains, in Tanzania. Positive correlations of varying significance were found between trunk diameter and crown area, as well as crown area and number of reiterations. These findings suggest that the broad distribution of this tree species lies in its ability to capture light efficiently during its initial stages, by growing rapidly on the vertical axis and then by reiterating and expanding its crown area on the canopy. An interesting finding is that the tree produces growth rings, despite being a tropical species.

Maria Kampouri, King's College London, UK

Sara Sällström, University of Uppsala, Sweden

2002

**The factors influencing the abundance and distribution of *Clidemia hirta*
in Amani Nature Reserve**

Abstract

The main goal of this project was to examine the abundance of *Clidemia hirta*, an invasive plant, affected by both disturbance and environmental factors. Comparison of number of *Clidemia* between two trails of different size was carried out and showed that the larger trail had more individuals of *Clidemia* and was associated with particular variables. The distance from the edge into the forest and environmental factors such as temperature, light intensity and relative humidity influenced the number of *Clidemia* between plots. The vigour of the plants was tested by considering the height and the diameter. These parameters both decreased from edge to interior. The percentage of herbivore did not show any correlation with the number of fruits.

Ethel Bei Cham, University of Yaounde, Cameroon

Rajabu Hochi, University of Dar es Salaam, Tanzania

Voahiraniaina Razafintsalama, CFPF Morondava, Madagascar

2007

**Tree species composition and abundance of invasive species
in selected parts of Amani Nature Reserve (ANR) forest, Tanzania**

Abstract

This study investigated the dominant tree species at three sites within the Amani Nature Reserve, as well as the frequency and distribution of invasive tree species. At each site, 3 transects were established at 100 m interval; four 10m² plots were established at 50 m intervals. In each plot, tree species diameter (DBH \geq 5 cm) and canopy coverage were recorded. Data for each tree species included the basal area, species density, relative density, relative frequency, species dominance and Importance Value Index (IVI). The diameter class distribution for the most abundant trees was established. Three species, *Maesopsis eminii*, *Cedrella odorata* and *Castilloa elastica*, were found to be the most abundant and dominant invasive species.

Chemeda Abedeta, Addis Ababa University, Ethiopia

Aimé-Christian Amani Ya Igugu, Université Officielle de Bukavu, Democratic Republic of Congo

2007

Influence of forest trails and forest edges on the spread of *Clidemia hirta* in Amani Nature Reserve

Abstract

The aim of this project was to assess the influence of forest trails and forest edges on the spread of *Clidemia hirta* in ANR. Transects were laid randomly along the trails and the forest edge and plots of 2 x 2 m were established long the transects. In each sample plot, number and height of *Clidemia* plants and fruits were recorded. The canopy cover was also estimated. *Clidemia hirta* was found to be most abundant at the forest edge and along the trails. *Clidemia* plants were mainly found in the open and disturbed parts of the forest (forest edge and trails) with relatively sparse canopy cover. There was no association between the height of the plants and the edges/trails. *Clidemia hirta* vigour decreased with increasing distance away from the trail/forest edge. There was no association between slope and the density of *Clidemia hirta* plants.

Golden Bells Tayebwa, Makerere University, Kampala, Uganda

Mohammednur Jemal Yune, Oromiya Bureau of Agr. and Rural Development, Ethiopia

2007

The struggle of *Lantana camara* to survive in forest gaps in Amani Nature Reserve

Abstract

This study aimed at assessing the survival of *Lantana camara* (L., 1758) in forest gaps. It was carried out in the secondary forest on Mbomole Hill in Amani Nature Reserve in August 2009. 15 quadrats were laid in 8 different gaps in the forest and 30 quadrats at forest edge. The number of leaves, stems, branches and height of the plants was measured to assess vegetative growth. The number of inflorescences, flowers and fruits were counted and nectar measurements taken to assess reproductive success. Herbivory and predation on artificial caterpillars was estimated. There was less vegetative growth, less reproductive success and more herbivory in the forest. This shows that *Lantana camara* is less successful in the forest gaps than at the edges.

Carol Bogezi, Wildlife Conservation Society (Uganda) and Makerere University, Uganda

Godgift Swai, Sokoine University of Agriculture, Tanzania

Daniel van Denderen, Leiden University, The Netherlands

2009

ECOLOGY

Effects of *Maesopsis* on the fauna of the Amani Nature Reserve in the East Usambara Mountains, with specific reference to forest litter amphibians

Abstract

This field study was carried out from September 17-22, 1998 at Amani Nature Reserve of the East Usambara forest in north eastern Tanzania. Two buckets were fixed in pits dug 10 m apart in *Maesopsis*-poor and *Maesopsis*-rich habitats, and were connected by a drift fence. The three rounds of trapping yielded 74 individual amphibians divided over 7 species. There was a statistically significant difference between the amphibian diversities of the two different habitat types. This suggested that *Maesopsis* had a profound effect on the amphibian diversity by having an influence on the under storey habitat complexity.

Sarah Nachuha, Makerere University, Uganda

Paul Waswa Webala, Institute of Primate Research, Kenya

1998

The ecology of *Phyllostachys bambusoides* and its impact on indigenous tree species in Amani Nature Reserve

Abstract

To investigate the ecology of *Phyllostachys bambusoides*, an introduced bamboo species, and its impact on the natural ecosystem in the area of Amani Nature Reserve, thirty two quadrats (2 m x 2 m) were laid in four randomly selected sites in the study area. Soil samples were collected at each quadrat at a depth 10 cm to measure the moisture content and pH of the soil. Other ecological variables such as canopy closure, slope, altitude, ground leaf litter cover and degree of predation were measured. The number of the bamboo stems and different tree seedlings in each quadrat were recorded. Test statistics of the sample data revealed that there is no significant variation in the number of *P. bambusoides* with respect to changes in the recorded ecological variables. However, there is significant evidence that the bamboo species has a negative impact on the regeneration potential of native tree species.

Tamrat Andargie Belay, Addis Ababa University, Ethiopia

Hanitriniony Rakotojaona, Antananarivo University, Madagascar

2000

Factors affecting the invasive success of *Clidemia hirta* in Amani, Eastern Usambara Mountains

Abstract

We investigated the growth habit and herbivory of *Clidemia hirta*, family Melastomaceae, in varying light conditions and at different site types. Our results show that *Clidemia* grows most densely where there is most light, as expected. Berry production and herbivory are not linked to light in the same way, however. Both abundance of berries and level of herbivory are related to the type of site; those sites along the edges of pathways having more berries and more herbivory, regardless of light. *Clidemia* is attacked by generalist herbivores, and suffers less from herbivory than other plant species in the same site. We can conclude that both pollination and herbivory are increased along edges, where there is greater access to plants for generalists who, without the disturbance of paths, may otherwise be prevented from entering the forest.

Caroline Buckee, University of Edinburgh, UK

Sofie Tind Nielsen, University of Copenhagen, Denmark

2000

Regeneration and population structure of the alien tree species *Maesopsis eminii* in Amani Nature Reserve

Abstract

A study was carried out in Amani Nature Reserve, Tanzania to assess the invasive potential of *Maesopsis eminii*. It involved determining the population structures of the species in a disturbed and intact forest. It was found that, contradictory to other studies, *Maesopsis eminii* is not of an invasive nature in the intact forest site in Amani Nature Reserve. Instead, it is long established in sites that have been subject to disturbances.

Michael Adams, University Of Vienna, Austria

Daniel Waiswa, Makerere University, Uganda

2000

The relationship between *Maesopsis eminii* and *Anisophyllea obtusifolia* regeneration along a slope

Abstract

Observations were made on the occurrence of seedlings of *Maesopsis eminii* and *Anisophyllea obtusifolia* at three positions along the slope of a hill namely, the top, the middle and the bottom. Data were collected from a closed forest patch near Amani in three quadrat sizes, 16m², 4m² and 1m². The main objective was to determine whether the two species' seedlings occur associated at each of the three sites along the slope. Our results showed that there is positive association between *Maesopsis* and *Anisophyllea* for all quadrat sizes and for all positions on the slope. In other words, despite differences in number, seedlings of these two species are often found growing in the same place. The study shows that canopy closure is not responsible for this association but possible causal factors for this relationship are briefly discussed.

Aisha Abdalmaboud Mohammed, University of Khartoum, Sudan

Joel Mpalanyi Musaasizi, Makerere University, Kampala Uganda

2000

Relationship between seed predation of *Maesopsis eminii* and gaps

Abstract

The hypothesis, that seed predation is more intense in a gap than at the edge of it or in the surrounding forest, could not be supported. Even the opposite trend was visible, although not significant: most artificial seeds that were left intact were found in the gap. This finding could be due to the high fragmentation and disturbance of the forest producing less distinct gaps. Comparing the predation rate on *Maesopsis* fruits and seeds, a significant difference was detected: only a small percentage of seeds were removed (1.7%) whereas every third fruit suffered post-dispersal predation. An edge effect on the amount of predation could be detected: the closer to the edge, the more fruits were removed.

Ketakandriana Vonintsoa, University of Antananarivo, Madagascar

Muriel Bendel, University of Berne, Switzerland

2000

The agro-ecological importance of invasive species on farmlands in the East Usambara Mountains: Case species *Lantana camara*, *Clidemia hirta* and *Rubus rosifolius*

Abstract

We investigated the percentage surface coverage of invasive species - *Lantana camara*, *Clidemia hirta* and *Rubus rosifolius* on farmlands in relation to the coverage of agricultural crops. We also studied the agro-ecological relationships that exist between crops and the invasive species. The results revealed that all the eight farms surveyed had a reasonable percentage cover of at least one or a combination of the studied invasive species. It was clear also from results that there's an inverse relationship between percentage average cover of crops and that of invasive species. A field observation of interfaces between agricultural crops and the invasive species revealed poor health of crops, thus, an ecological impact to crops affecting their productivity.

Wasike Mahmoud Mukoche, Egerton University, Kenya

Bakari Salim Mohammed, Tanga Catchment Forestry Project, Tanzania

2001

Herbivory of *Clidemia hirta* in two sites within Amani Nature Reserve

Abstract

Leaf damage caused by natural enemies of *Clidemia hirta* was investigated in two sites within Amani Nature Reserve with respect to light environment, density of conspecifics and reproductive status. There is little evidence from the result to suggest that the light environment influences level of herbivory. Reproductive status of plants was also shown to have no influence on the level of herbivory. However, leaf damage in non-reproductive plants from 'bird walk' was found to correlate significantly with distance to nearest conspecific. No difference was found to exist in level of herbivory between leaves of different age. On the basis of insect collections we propose that leaf herbivory at the two sites is carried out by native generalist herbivores.

Wilhelm A. Kiwango, Sokoine University of Agriculture, Tanzania

Ben Butler, University of Cambridge, England

2002

Fruit productivity and other life history traits of *Maesopsis eminii* at a forest edge and in a closed habitat of Amani, East Usambara Mountains

Abstract

The amount of fruits produced by tree species in tropical forest ecosystems depends on water availability, soil types, amount of isolation and structural features among other factors. Fruit productivity of the introduced invasive tree *Maesopsis eminii* at the edge and in closed habitats was investigated at three different study sites within Amani Nature Reserve (ANR), East Usambara Mountains -Tanzania. Fruits Productivity was assessed by visually estimating the amount of fruits in the tree canopies as well as by counting the fruits dropped on the forest floor. Additional variables namely leaf size, fruits weight, canopy diameter (m), canopy height (m), DBH and canopy cover of each tree were collected. Results show that there is no difference in the amount of fruits produced by *Maesopsis* trees between the edges and the closed habitats whereas edge trees had heavier fruits which may be related to the greater leaf biomass per unit space. It was detected that the canopy diameter of trees in closed habitats was larger than of those at the edges. The trees of the latter were found to have larger leaves. As the canopy volume in the two habitats is similar the crowns of edge trees are more packed and thus contain a greater leaf area index. This might be responsible for a greater leaf biomass per unit space (or relative assimilation rate) in the edge trees.

Simon Nganda Musila, National Museums of Kenya, Kenya

Philipp Leonhartsberger, University of Vienna, Austria

2003

Reproduction of *Ageratum conyzoides* depending on light and flower colour

Abstract

This study carried out in Amani Nature Reserve, focused on the reproduction of a grassland plant *Ageratum conyzoides*. The comparison of the Reproduction Allocation (RA) and the density of this species in open and semi-shaded area in two different habitats showed no difference. We carried out the study in five different sites and two different (flower) colour-type of the plant. Reproductive Allocation was not dependent on habitat, but differed from site to site. The mean density showed no difference between the habitats. For the plant with two different colours (violet, white), the leaves and flowers weight showed difference between the two colours of flower. In biomass, violet-flowered plants had high weight than white-flowered plants. White flowers had higher biomass than violet flowers.

Amel Abdallah Hassan, University of Khartoum, Sudan

Rahantavololona Vonimanitra Juliana Rasoma, University of Antananarivo, Madagascar

2003

Effect of shade on leaf length, leaf area, stem diameter and coverage of *Lantana camara* under *Maesopsis eminii* and *Cinnamomum camphora* dominated sites in Amani Nature Reserve, East Usambara Mountains

Abstract

Two adjacent sites, one dominated by *Maesopsis eminii* and the other by *Cinnamomum camphora* were selected for the study. During site selection we found the two sites look a bit different in *L. camara* distribution and density and this study therefore investigated the effect of shade on leaf area, length, stem diameter and coverage of *Lantana camara*. Our results show that, shade is not the only limiting factor for *L. camara* distribution. The effect of shade on leaf area, length and stem diameter was very minimal at the ranges encountered.

Rose Mndemi, Sokoine University of Agriculture, Tanzania

Tariku Hunduma Tolera, Ethiopian Agriculture Research Organization, Ethiopia

2005

Seedling dynamics under *Maesopsis* tree canopy in different forest conditions at Amani Nature Reserve (ANR)

Abstract

There is much discussion on the threat of *Maesopsis* in Amani on native floral diversity. A study was conducted to examine the seedling kinds and seedling diversity and distribution under *Maesopsis* trees in three forest conditions. Ad hoc and systematic sampling, including transecting were adopted in collecting data. A total of 59 forest tree species were existing under the *Maesopsis* trees. Populations of seedlings under *Maesopsis* and native trees were not significantly different. About 63% of the seedlings under *Maesopsis* were climax species. Diversity was highest under *Maesopsis* trees in the secondary forest. Significantly higher numbers of seedlings existed within the inner 2m-radius of the crown than the outer part.

Bertrand Festus Nero, Kwame Nkrumah University of Science and Technology, Ghana

Mayada Mamoun Beshir Mohamed, University of Khartoum, Sudan

2005

Small mammals as potential seed predators of *Maesopsis eminii*

Abstract

Rodent preference for *Maesopsis eminii* was investigated. Propagules in different stages of development (ripe, unripe, seed, nut and nutcase) were offered in paired plots under *M. eminii* trees and under a native forest tree species. Small mammal activity in each of the plots was monitored using track plots. The information was supplemented by setting up two rodent trapping grids. Small mammals were active in the experimental area, although they were not all frugivores. Small mammals selected for bare seeds and ripe fruits and the preference did not differ between the paired plots. Total propagule utilisation decreased with increased % of woody debris cover only under *M. eminii* plots. Rodents were not shown to be important sources of *M. eminii* seed predation and dispersal on a local scale.

Robert Buitenwerf, Rijksuniversiteit Groningen, Netherlands

Nicola Stevens, Rijksuniversiteit Groningen, South Africa

2005

Comparison of insect diversity on confamilial native and alien species of shrubs: A case study of Amani Nature Reserve

Abstract

As one of the biodiversity hotspots of the world, rich in endemic flora and fauna, the ecosystem of Amani Nature Reserve has been greatly influenced by the introduction of alien species. The study evaluated insect diversity and abundance on five pairs of native and alien confamilial shrubs. There was a positive correlation between the number of insect individuals and species on different host plants. Native species were more species rich whilst alien species had a higher number of insect individuals. There was a high overlap in species composition of insects between native and alien plants.

Louis Addae-Wireko, Kwame Nkrumah University, Ghana

Alemayehu Mamo, Addis Ababa University, Ethiopia

Oluwayinka Omolara Iseyemi, University of Ibadan, Nigeria

2006

Herbivory and predation on *Clidemia hirta* and native plant species in Amani Nature Reserve

Abstract

This study was carried out in Amani Nature Reserve and focused on herbivory and predation on *Clidemia hirta* and native plant species in forest paths and forest gaps. Herbivory was measured by percentage leaf loss estimation and predation by the use of dummy caterpillars made from plasticine. There was a higher degree of leaf herbivory on native plant species than on *C. hirta*. The level of predation was 26.4% overall (96 caterpillars out of 364), higher in the forest gap than in the forest path.

Ann Githaiga, Egerton University, Kenya

Jennifer Agaldo, University of Jos, Nigeria

2009

Benefits of an invasive species: the relationship between *Maesopsis eminii* and its frugivores

Abstract

This study investigated the importance of *Maesopsis eminii* as a food source to the numerous species of frugivores in Amani Nature Reserve. The results showed that *M. eminii* was a food source for numerous bird species of which two are endemic to the Eastern Arc Mountains and analyses of species accumulation curves suggested that the number is in fact above 30 species. Furthermore fruits of *M. eminii* seemed to be an important food source for squirrels, primates and night active animals such as bats and rodents. The vertebrate groups mentioned above were found to have approximately the same effect on fruit fall as wind/gravity. This suggested these animals' importance as seed dispersers of *M. eminii*. *M. eminii* was estimated to produce large quantities of fruits, making on average 87.4 kg of ripe fruit per tree available to the frugivores. This study implied that the invasive *M. eminii* might actually be beneficial to the frugivores of Amani Nature Reserve and has established an important relationship as a food source for frugivores and in return seems to receive seed dispersal benefits.

Christina Lehmkuhl Noer, University of Copenhagen, Denmark

Gwom Thomas, University of Jos, Nigeria

Leona Fahey, National University of Ireland, Galway, Ireland

2010