Department of Agricultural
Economics and Rural Development

Socio-economic, land use and value chain perspectives on vanilla farming in the SAVA region (north-eastern Madagascar): the Diversity Turn Baseline Study (DTBS). July 2019 Edition

Discussion Paper 1806

Hendrik Hänke,
Jan Barkmann, Lloyd Blum, Yvonne Franke, Dominic A. Martin,
Janna Niens, Kristina Osen, Viviana Uruena, S. Annette
Witherspoon, Annemarie Wurz

Department of Agricultural Economics
and Rural Development
University of Goettingen
D 37073 Göttingen
ISSN 1865-2697

Diversity turn in land use science, the importance of social diversity for sustainable land use innovations using the example of vanilla farming in Madagascar.

WP1: Project Management, Coordination, Theoretical Advancement

Prof. Dr. Andrea D. Bührmann[1)], Dr. Yvonne Franke[1)], Prof. Dr. Rainer Marggraf[2)], Dr. Hendrik Hänke[2)]

[1)] Göttingen Diversity Research Institute, Faculty of Social Sciences, University of Goettingen

[2)] Research Unit Environmental-and Resource Economics, Department of Agricultural Economics and Rural Development, University of Goettingen

WP2: PhD program "Diversity Turn in Sustainability Science"

Prof. Dr. Andrea D. Bührmann, Dr. Yvonne Franke

Göttingen Diversity Research Institute, Faculty of Social Sciences, University of Goettingen

WP3: Social Diversity and Power Relations

Prof. Dr. Andrea D. Bührmann[1)], Annette Witherspoon[1)], Raozivelo Ony Solomampionona[2)]

[1)] Göttingen Diversity Research Institute, Faculty of Social Sciences University of Goettingen

[2)] Department of Sociology, Faculty of Law, Economics, Management and Sociology (DEGS), University of Antananarivo

WP4: Preferences for Contract Farming Arrangements, Economic and Institutional Restrictions in the Vanilla Value Chain

Prof. Dr. Jan Barkmann[1), 2)], Lloyd Blum[1), 2)], Fanilo Andrianisaina[3)], Matteo Parisi[2)]

[1)] Faculty of Social Sciences, Risk- and Sustainability Sciences, University of Applied Sciences of Darmstadt

[2)] Faculty of Agricultural Sciences, University of Goettingen

[3)] Faculty of Agricultural Sciences, University of Antananarivo

WP5: Trust and Markets

Prof. Dr. Marcela Ibañez Diaz, Viviana Uruena,

Research Centre "Poverty, Equity and Growth in Developing Countries", Faculty of Economics, University of Goettingen

WP6: Competencies for Rural Madagascar

Prof. Dr. Susanne Bögeholz, Janna Niens

Albrecht-von Haller-Institute for Plant Science, Faculty for Biology and Psychology, University of Goettingen

WP7: Animal Husbandry as a Means of Income Diversification

Prof. Dr. Eva Schlecht

Animal Husbandry in the Tropics and Subtropics, Faculty of Organic Agriculture, Georg-August-University and University of Kassel

<u>WP8: Biodiversity and Ecosystem Services of Agro-ecologically Optimized Land Use</u>

Prof. Dr. Teja Tscharntke[1)], Dr. Ingo Grass[1)], Annemarie Wurz[1)], Andry Ny Aina Rakotomalala[2)], Jeannie Marie Estelle Raveloaritiana[3)]

[1)] Faculty of Agricultural Sciences, Department of Crop Sciences, Agroecology
[2)]Department of Entomology, Faculty of Science, University of Antananarivo
[3)]Department of Plant Biology and Ecology University of Antananarivo

<u>WP9: Conservation of Biological Diversity</u>

Prof. Dr. Holger Kreft[1)], Dominic Martin[1)], Thio Rosin Fulgence [2), 3)]

[1)]Biodiversity, Macroecology and Biogeography, Faculty of Forest Sciences and Forest Ecology, University of Goettingen
[2)]Department of Animal Biology, University of Antananarivo
[3)]Regional University Center of the SAVA region (CURSA)

<u>WP10: Trees in the Vanilla Production Landscape</u>

Prof. Dr. Dirk Hölscher[1)], Kristina Osen[1)], Marie Rolande Soazafy[2)]

[1)] Tropical Silviculture and Forest Ecology, Faculty of Forest Sciences and Forest Ecology, University of Goettingen
[2)] Doctoral School on Natural Ecosystems (EDEN) of the University of Mahajanga
[3)] Regional University Center of the SAVA region (CURSA)

<u>Partners:</u>

University of Antananarivo

Regional University Centre of the SAVA region (CURSA)

Madagascar National Parcs

ABSTRACT

The SAVA region in north-eastern Madagascar is the global centre of vanilla production. Here, around 70,000 farmers are estimated to produce 70-80% of all global *bourbon* vanilla. Yet, little is known about the farming population, their livelihoods, and the impact of vanilla cultivation on biodiversity.

This publication presents the results of the Diversity Turn Baseline Survey (DTBS) that was conducted in 2017. The survey provides baseline data on the socio-economic characteristics and living conditions of the local population, and farming of vanilla as well as the most important other crops (n=1,800 households). As international demand for natural vanilla has increased considerably, special emphasis is placed on the vertical integration of vanilla farmers into the global vanilla value chain. This integration is increasingly accomplished through contract farming arrangements between vanilla farmers, collectors and exporters.

After a first rise in vanilla prices in 2015, the current vanilla boom took off in 2016 and was still in full swing in 2017. Consequently, the start of the price boom coincides with this survey and its retrospective questions often address the situation in 2016. The large majority of the surveyed households (HHs) in the study region practice vanilla farming (83%). Of these, only 15% conclude formal contracts while the majority of farmers (63%) sell their vanilla in informal spot markets often depending on several middlemen. Our data show that the socio-economic situation of smallholder vanilla farmers has recently improved when considering vanilla prices received, education, access to electricity and ownership of assets. However, under the high vanilla prices, theft and crime are now key constraints for vanilla farmers.

In addition to descriptive statistics, this publication compares selected data between male- and female-headed HHs, poor and non-poor HHs, and HHs with- and without contracts. Members of female-headed HHs have significantly lower education, lower labour availability, smaller fields and lower vanilla harvests than male-headed HHs. HHs with contracts possess more assets, are better educated, have higher labour availability, larger vanilla plots, and larger vanilla harvests than HHs without contracts.

The DTBS confirms a number of benefits for smallholders who conclude contracts with vanilla exporters or collectors. Among these benefits are the significantly higher vanilla prices even during market peaks. However, the distribution of HHs with or without contracts is skewed indicating entry barriers for certain groups of smallholders. For example, female-headed HHs were significantly less likely to have a contract than male-headed HHs, and it appears that HHs with a contract had already been less poor than HHs without a contract prior to entering contract arrangements.

RÉSUMÉ

La région de la SAVA au nord-est de Madagascar est le centre mondial de la production de vanille. Ici, environ 70 000 paysannes produisent 70 à 80% de la *bourbon* vanille globale. Cependant, on en sait peu sur la population agricole, ses moyens de subsistance et l'impact de la culture de la vanille sur la biodiversité.

Cette publication présente les résultats de l'enquête DTBS (*Diversity Turn Baseline Survey*) de 2017. L'enquête fournit des données de base sur les caractéristiques socio-économiques, les conditions de vie de la population locale et les cultures plantées (n = 1800 ménages). La demande internationale de vanille naturelle ayant augmentée, l'accent a été mis sur l'intégration verticale de la vanille dans la chaîne de valeur mondiale de celle-ci. Cette intégration est de plus en plus effectuée entre les producteurs de vanille, les collecteurs et les exportateurs.

L'enquête couvre souvent la situation en 2016 car c'est l'année où la demande en vanille a explosée. La grande majorité des ménages interrogés pour cette étude pratique la culture de la vanille (83%). Parmi ceux-ci, seulement 15% concluent des contrats formels, tandis que la majorité (63%) vend leur vanille sur des marchés informels, dépendant souvent de plusieurs intermédiaires. Nos données montrent que la situation socio-économique des petits producteurs de vanille s'est récemment améliorée, comme par exemple au niveau des revenus de la vanille, de l´éducation, l´accès à l'électricité et la propriété des biens. Compte tenu des prix élevés de la vanille, le vol et la criminalité sont désormais des contraintes majeures pour les producteurs de vanille.

Mis à part des statistiques descriptives, cette publication compare également certaines données entre les ménages dirigés par un homme et ceux dirigés par une femme, les ménages pauvres et non pauvres, et les ménages avec et sans contrat. Les membres des ménages dirigés par des femmes ont un niveau d'éducation nettement inférieur, une disponibilité de main-d'œuvre plus faible, des champs plus bas et des récoltes de vanille inférieures à celles des ménages dirigés par des hommes. Les ménages avec des contrats ont plus d'avoirs, sont plus instruits, ont une plus grande disponibilité de main-d'œuvre, des parcelles de vanille plus grandes et des récoltes de vanille plus importantes que les ménages sans contrat.

La DTBS confirme des bénéfices pour ceux qui concluent un contrat avec des exportateurs ou des collectionneurs de vanille. Parmi eux, les prix reçus pour la vanille sont nettement plus élevés. Cependant, la distribution des ménages avec ou sans contrat est biaisée. Par exemple, les ménages dirigés par des femmes ont beaucoup moins de chances de conclure un contrat que ceux dirigé par un homme. De plus, il semble que les ménages sous contrat aient déjà été moins pauvres que les ménages sans contrat avant de passer des accords contractuels.

CORRIGENDUM TO PREVIOUS EDITIONS OF THE DTBS

The authors regret to inform that the 1st edition of the DTBS contained two mistakes. Figure 2 cited the data by DRAE 2018 wrongly as green vanilla prices in Sambava. However, the data by DRAE 2018 shows prices for black vanilla in Sambava. Likewise, the data in Fig.14a, 28, 29 & 30 illustrated the prices for green vanilla in FMG, not in Malagasy Ariary as it was designated in the legend. The data has been corrected for this edition of the DTBS.

Likewise, as described in the sampling section, we followed a protocol to randomize the selection of all households in 2017. However, in subsequent visits by our research team in 2018, we found that this did not work out in at least 8 villages (13.3% of all villages). E.g. WP4 did a subsample of 14 villages in 2018, whereas they found a sampling bias in 4 villages. We have reason to believe that either village chiefs contributed to a bias in household selection or that our team-leaders did not follow sampling instructions strictly enough.

TABLE OF CONTENTS

I. FIGURES

II.TABLES

III. APPENDIX

IV. ABBREVIATIONS

CFA	Contract farming arrangement
CURSA	Centre Universitaire Régional de la SAVA (*Regional University Center of the SAVA*)
DRAE	Direction Régionale de l ´Agriculture et Elèvage (*Regional authority for agriculture and animal husbandry*)
DTBS	Diversity Turn Baseline Study
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (*German Corporation for International Cooperation*)
HH	Household
MD	Multidimensional
MDG	Millennium Development Goals
MNP	Madagascar National Parks
MPI	Multidimensional Poverty Index
NE	North-eastern
NGO	Non-Governmental Organization
NTFP	Non-Timber Forest Product
PPN	Produits de Première Nécessité (*Essential products*)
SAVA	Sambava-Antalaha-Vohémar-Andapa (SAVA region)
SRI	Sustainable Rice Intensification
WP	Work-package
χ^2	Chi square test

V. CONTRIBUTING AUTHORS AND STAFF

Lead author

Dr. Hendrik Hänke, Research Unit Environmental- and Resource Economics, Department of Agricultural Economics and Rural Development, University of Goettingen

Contributing authors

Jan Barkmann, Department of Agricultural Economics and Rural Development, University of Goettingen & Department of Social Sciences, Hochschule Darmstadt – University of Applied Sciences

Lloyd Blum, Ph.D. candidate, Research Unit Environmental- and Resource Economics, Department of Agricultural Economics and Rural Development, University of Goettingen

Dr. Yvonne Franke, Goettingen Diversity Research Institute, Faculty of Social Sciences, University of Goettingen

Dominic A. Martin, Ph.D. candidate, Biodiversity, Macroecology and Biogeography, Faculty of Forest Sciences and Forest Ecology, University of Goettingen

Janna Niens, Ph.D. candidate, Didactics of Biology, Albrecht-von-Haller-Institute for Plant Science, Faculty of Biology and Psychology, University of Goettingen

Kristina Osen, Ph.D. candidate, Tropical Silviculture and Forest Ecology, Faculty of Forest Sciences and Forest Ecology, University of Goettingen

Viviana Uruena, Ph.D. candidate, Research Centre "Poverty, Equity and Growth in Developing Countries", Faculty of Economics, University of Goettingen

Annemarie Wurz, Ph.D. candidate, Agroecology, Department of Crop Science, Faculty of Agricultural Sciences, University of Goettingen

Annette Witherspoon, Ph.D. candidate, Goettingen Diversity Research Institute, Faculty of Social Sciences, University of Goettingen

Local Coordinators:

Fenoahja Soavita, Office Manager in Sambava, Madagascar

Guillaume Velotody, Field Coordinator in Sambava, Madagascar

Student assistants from the CURSA (*Centre universitaire de la Région de la Sava*)

Amina Rasoa
Hermel Tharsa Andrianarison
Ophélia Hyasmine Beanana
Erosinot Jean Befidimanana
Grimo Sedric Jaona
Berthine Marie Maminirina
Rodinien Mila Mamonjiniaina
Amedé Marc
Givelancia Niny
Théogis Jean Rabe
Lucia Be Rafanomezantsoa
Peronette Raharivololona
Romual Randriamanantena
Yockline Marcelle Randrimihanta
Marie Elina Rasoa
Marie Samira Rasoanirina
Jean Caliste Ravelonantenaina
Théogène Razafimaheza
Jacqueline Estenie Soa
Theudy Alexis Solofoniaina

Management board of the "Diversity Turn" research project:

Prof. Dr. Jan Barkmann, Risk- and Sustainability Sciences, Department of Social Sciences, University of Applied Sciences of Darmstadt; Associate Lecturer at the Faculty of Agricultural Sciences, University of Goettingen

Prof. Dr. Andrea Bührmann, Goettingen Diversity Research Institute, Faculty of Social Sciences, University of Goettingen

Dr. Yvonne Franke, Goettingen Diversity Research Institute, Faculty of Social Sciences, University of Goettingen

Dr. Hendrik Hänke, Research Unit Environmental- and Resource Economics, Department of Agricultural Economics and Rural Development, University of Goettingen

Prof. Dr. Rainer Marggraf, Research Unit Environmental- and Resource Economics, Department of Agricultural Economics and Rural Development, University of Goettingen

Dr. Doreen Müller, Goettingen Diversity Research Institute, Faculty of Social Science, University of Goettingen

VI. SHORT DESCRIPTION OF THE RESEARCH PROJECT

Land use substantially impacts human living conditions and livelihoods worldwide. Due to the complex interaction of ecological, economic and social factors, the design of land use innovations is an exemplary case of sustainability research. Land use research requires a balanced attention to biophysical aspects of ecological systems as well as to the social arrangements that shape rural land use.

The conditions, actors, institutions and forces shaping rural land use are very diverse within the realm of both, social and the ecological systems. Yet, a systematic integration of the state-of-the-art in the social science diversity debate is still lacking for environmental sustainability research generally as well as for land use research in particular. Thus, it is the overall aim of this project to foster a diversity-sensitive perspective for land use research. To achieve the overall aim, we investigate a specific, ongoing social-ecological transformation process: The introduction of vertical market integration into the vanilla value chain in north-eastern Madagascar. As an integral component of the project, we investigate local power relations potentially influencing socio-economic development.

Ecologically among the countries with highest endemism rates, Madagascar´s north-eastern region is home to UNESCO World Heritage forest areas. These forests are of exceptional global conservation value but are under high degradation pressure. On the other hand, despite being the world's largest producer of natural vanilla – one of the most valuable spices –, the country remains one of the ten poorest in the world.

The approach of the project is decisively transdisciplinary. A transdisciplinary research approach aims at transgressing academic disciplines where useful, and incorporating a broad range of actors and stakeholders from both inside as well as outside of academia. The approach is, *inter alia*, expected to help in the identification of the multiple and complex levels of analysis required to investigate the factors influencing the impacts of the current transformation processes in the project region. The integration of stakeholder input into the research process is facilitated using qualitative and participatory research approaches and methods, such as open interviews, consultations, stakeholder reviews and feedback meetings.

A detailed description of the ten different Work-packages (WPs) and the contributing researchers can be found in Appendix 1.

VII. ACKNOWLEDGEMENTS

Conducting such a comprehensive survey is a complex task requiring the involvement of many individuals. First of all, we would like to thank all enumerators who supported data acquisition, and the members of 1,800 households who patiently answered our questions. We would also like to thank the drivers that transported our scientists and enumerators as well as members of the local women associations who prepared food. Thank you to all *chef du villages who* supported data collection, e.g., by providing population lists and by organizing meetings with households targeted for the survey. Special thanks go to Fenohaja Soavita Babarezoto and Guillaume Velotody, our local coordinators. Without them, the DTBS data collection would not have been possible. We also would like to thank Hugo Bertram Rohrbeck for graphical support and Zinzi Dzuda for proof-reading. Thanks are also due to the Volkswagen Foundation, which is generously funding the Diversity Turn project.

VIII. CLARIFICATION OF IMPORTANT TERMS

Some terms are key to our research project and they will reappear throughout this report. Among them are **contract farming arrangements (CFAs)**, **vertical integration**, **certifications/private voluntarily standards**, **social diversity**, common **buyers/middlemen** in the vanilla value chain and **multidimensional poverty**. In this introductory section, we provide a short background on those terminologies.

A. Vertical integration and Contract farming arrangements (CFAs)

Vertical integration means that production processes along a value chain are centrally coordinated. An increasing interest in vertical integration originates from the need to safe-guard the process quality of agricultural products, e.g., if advertised as *organic*, produced under *Fair Trade* conditions or related to Corporate Social Responsibility programmes targeting consumers in high-income countries (Henson and Jaffee 2004, Swinnen 2007). Without contractually guarded vertical integration, respective quality claims are difficult to substantiate. Vertical integration is included to different levels in CFAs (see Figure 1). CFAs are a mean to share risks between farmers and contractors, and CFAs have considerably increased in recent years (Barrett et al. 2012, Ton et al. 2018). The vertical integration of smallholder farmers into international value chains through contracts can reduce rural poverty (Pingali 2007, Barrett et al. 2012). However, the benefits arising from such contracts for poor small-scale farmers in developing countries are controversial (Little and Watts 1994, Key and Runsten 1999, Havnevik et al. 2007)

There are three common models of CFAs that differ in the level or risk-sharing, decision right transmission and the level of vertical integration between firm and farmer (Key and Runsten 1999, Anseeuw 2012; see Figure 1).

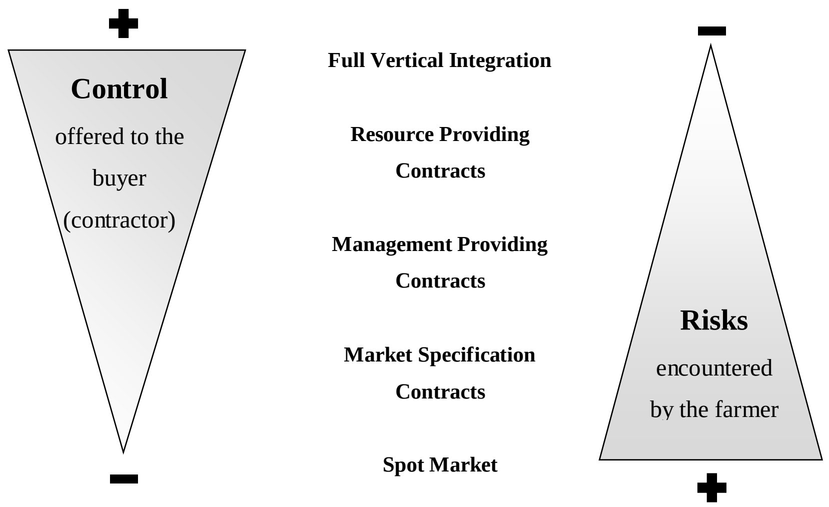

Figure 1: Level of control over production and risks encountered by farmers in different CFAs, Source: Anseeuw 2012

i. **Market-specification contracts** represent pre-harvest agreements that engage a buyer in providing a market outlet to a farmer under pre-agreed conditions. The contracted issues refer to price, quantity, quality and scheduling of the delivered products. The farmer transfers some risks to the buyer, while keeping control over production (Bijman 2008).

ii. **Management-providing (or production-management) contracts** include the same arrangements as market-specification contracts but in addition demand the adoption of particular farming practices (e.g. land management, fertilizer application rates and planting time) or post-harvest handling. The buyer exercises more stringent control over farming practices. In exchange, the buyer usually accepts more marketing risks (Bijman 2008).

iii. **Resource-providing contracts** can be close to a complete vertical integration. The buyer not only provides a market outlet but also delivers key inputs, such as credit, technology and/or technical assistance. How much risk and control is shifted from the farmer to the buyer depends on the individual contract as resource-providing contracts may just provide inputs and an output market to the farmer but leave most production decisions to the farmer (Bijman 2008).

B. Private Voluntary Standards

From a legal point of view, private standards are voluntary as they arise from a coordinated process in which key participants within an industry or commodity sector seek consensus. Voluntary standards may be introduced as a response to consumer preferences, or as a result of initiatives led by NGOs and industry associations. They are usually verified through third-party auditing. In contrast, mandatory standards are legally binding government regulations (Giovannucci and Ponte 2005). Mandatory standards may address technical requirements, testing, quality certification and labelling. In addition, government regulated voluntary standards exist, such as the European Union organics standard. While imported vanilla does not have to be certified 'organic' according to EU regulation, imported vanilla must conform to the EU Organic Regulations in order to be sold as organic in the EU.

The three most common voluntary sustainability standards used by vanilla trading companies in the SAVA Region are: Fair Trade (private/voluntary), EU Organic (voluntary, officially regulated), and Rainforest Alliance (private/voluntary) (see Table 1).

Table 1: Principals of EU Organic, Fair Trade and Rainforest Alliance Certifications (European Commission of Agriculture 2018, Fair Trade International 2018, Rainforest Alliance 2018)

Principles	**EU Organic**	**Fair Trade**	**Rainforest Alliance**
Improved livelihoods and human well-being -legal minimum wages paid to farmers and wage labourers -no use of child labour		x	x
Fixed minimum prices and price premiums -Certified farmers receive fixed-price premiums to add up to a fair minimum price that allow for continued production regardless of market prices. -When the market price is higher than the Fair Minimum Price, producers should receive the current market price or the price negotiated at contract signing		x	
Democratic decision making Farmers are expected to form cooperatives that distribute the price premium. Profits should be equally distributed among the farmers. All members have a voice and vote in the decision-making process of the cooperative		x	
Integrated planning and farm management -e.g. wide crop rotation as a prerequisite for an efficient management of soil fertility -taking advantage of on-site resources, such as livestock manure for fertiliser or feed produced on the farm -integrated pest management	x		x
Strict limits on synthetic inputs -reduction of chemical pesticide and synthetic fertiliser -reduction of livestock antibiotics and food additives	x		x
Prohibition of the use of genetically-modified organisms	x		
Biodiversity conservation -avoiding negative consequences on nearby protected areas and aquatic systems -maintaining wildlife corridors			x
Natural resource conservation -certified farms work to minimize soil erosion and compaction, water conservation, solid waste management			x

C. Common traders and middle-men in the vanilla sector

Rabatteurs: often live in the same villages as their customers, and offer their services to neighbours and extended family members. They buy and transport vanilla to commissionaires (see below) and instead of paying farmers a fixed fee at the point of sale, they pay them after the vanilla has been sold. Hence, it is a "relational contract" that is struck with *rabbateurs*.

Commissionaires: usually - but not necessarily - work in assistance with *rabatteurs* and sell further to collectors or preparators. They take a fixed up-front commission for their service of searching a supplier or a buyer, depending on whether they work for preparators or for farmers. Commissionaires usually pay cash to farmers directly at the moment of vanilla sales.
Commissionaires and *rabatteurs* are close types of middlemen, the main difference is that *rabatteurs* do not offer cash at the moment of vanilla sales.

Collectors: Collectors are employed and paid on a contractual basis by an exporter or preparator. Collectors usually buy vanilla from commissionaires and *rabatteurs.*

Preparators: Preparators cure and often store the vanilla. Some, often small, preparators are based directly in the villages, whilst others, usually bigger ones, are based in towns. Depending on their size, preparators can be collectors, buying green vanilla, while also selling cured vanilla to collectors or exporters.

Exporter: Exporting companies are in contact with collectors, preparators, international traders and flavour houses. Increasingly, they are also having direct connections to vanilla farmers, often involving CFAs. Increasingly, flavour houses and large international food corporations directly export their own vanilla supply (i.e. Danone, Nestlé, Symrise, among others). Many of their contracted farmers are also part of a certification scheme (i.e. Fairtrade, Organic and Rainforest Alliance).

D. Social diversity

Borne out of studies on the socio-cultural positioning of specific demographic groups, social diversity is concerned with the social production of inequalities. It investigates the life experiences of the marginalized, and the patterns and forms of societal power relations believed to underpin social inequality that shape their lives (Yuval-Davis 2006, Zanoni et al. 2010, Scambor and Struve 2016).

Diversity, from a theoretical perspective, advocates for acceptance, appreciation and respect of the different ways individuals and groups contribute to society. Diversity, in the social context, is concerned with social differences (gender, age, class, physical/mental ability, race, sexual orientation, religion) and how these differences are constructed and maintained through social structures.

Drawing on this basic understanding of social diversity, our project identifies relevant variations and employs the term across two socio-cultural spaces while emphasizing the role of power, defined in terms of capacity and influence of all actors.

1. The general local context at village and household arena: gender, age, wealth, class), ancestry, occupation, ability (knowledge and skills), marital status, parenthood, residence status;

2. Vanilla value chain at the production arena: principal occupation, gender, marital status, age, access to land, wealth, size and number of plot, plot management capacity, certification status, farmer association membership status and role, marketing preferences, diversified income sources.

E. Multidimensional poverty

Many studies assess poverty using household income or expenditure as a single poverty indicator. These studies fail to capture the multifaceted characteristics of poverty (Alkire et al. 2015). In contrast, the Multidimensional Poverty Index (MPI; Alkire and Foster 2011, UNDP 2018) uses ten indicators (Table 2).

Table 2: Calculation of the Multidimensional Poverty Index, Source: Alkire et al. 2015*

Dimension	Indicator	Deprived if…	Relative weight
Education	Years of schooling	No household member has completed five years of schooling.	1/6
	Child school attendance	Any school-aged child is not attending school up to the age at which they would	1/6
Health	Child mortality	Any child has died in the household	1/6
	Nutrition*	Any adult or child that, for whom there is nutritional Information is malnourished.	1/6
Living standard	Electricity	The household has no electricity at home	1/18
	Improved sanitation	The household's sanitation facility is not improved (according to MDG guidelines), or improved but shared with other households	1/18
	Safe drinking water	The household does not have access to safe drinking water (according to MDG guidelines) or safe drinking water is more than a 30-minute walk from home. Roundtrip	1/18
	Flooring	The household has a dirt, sand or dung floor	1/18
	Cooking fuel	The household cooks with dung, wood or charcoal.	1/18
	Assets	The household does not own more than one radio, TV, telephone, bike, motorbike, refrigerator and does not own a car or truck.	1/18

**Data on nutrition could not be sampled and, therefore, has a value of 0 (Alkire et al. 2015)*

We identify multidimensionally (MD) poor and MD non-poor HHs based on the MPI. The MPI methodology is increasingly used for global analysis and international comparisons (UNDP 2018). The MPI does not include cash income. Its 10 indicators cover three dimensions: education, health and living standards. Each of the three dimensions have a weight of 1/3 (a third) in sum but consist of different indicators. The MPI value is, thus, a value between 0-1. HHs are defined as MD poor if they are deprived in a third or more of all weighted indicators, or in other words, if they have a MPI value of ≤ 0.33 (Alkire et al. 2015, UNDP 2018).

1. INTRODUCTION

Madagascar ranks among the poorest countries in the world, with over ninety percent of its population living with less than US$2 per day (World Bank 2015a). However, its exceptional biodiversity, natural assets, and its young and growing population present potential for growth (IMF 2015, World Bank 2015b). With an increasing attention on the role of value chain development to fight rural poverty and to foster sustainable growth, there has been a proliferation of the approach across developing countries (Coles and Mitchell 2011), including Madagascar (Donovan et al. 2013). Value chain development can include the vertical integration of smallholder farmers into value chains via contract farming arrangements (CFAs). Some industry actors advocate vertical integration with the final aim to reduce the gap between producers and manufacturers (Donovan et al. 2013, Sielaff et al. 2014).

With respect to the vanilla value chain, CFAs were introduced to Madagascar around the early 2000s by international flavour houses and export companies, and have spread rapidly. This shift in vanilla sourcing and contracting is generally presented as a success story by enterprises, development agencies and NGOs. However, empirical evidence of the effect on vanilla farmer livelihoods and biodiversity are so-far lacking.

The SAVA region in north-eastern Madagascar delivers a large share (80%) of all global *bourbon* vanilla supply (CNV International 2018). Yet, little is documented about its producer communities and the value of vanilla cultivation for regional biodiversity. Employing an inter- and transdisciplinary research approach, the Diversity Turn Project investigates this process to assess the social, economic and ecological benefits for smallholder farmers and biodiversity.

The Diversity Turn Baseline Study (DTBS) aims to provide information on livelihoods in the SAVA region with a special focus on vanilla farmers. It provides baseline data for the identification of villages and households (HHs) for upcoming research. Furthermore, the DTBS provides quantitative information on our study region profiling central characteristics of vanilla farmers and vanilla farms. A special emphasis is placed on living standards, socio-economic differences and CFA adoption. With little available data on the study region, this baseline was set up to fill the data gap and provide a point of reference throughout the research project.

The DTBS report is organized in five main sections:

- an introduction, which presents a review of demographic, historical, socio-cultural and market context of the study region, the explorative research work prior to this survey, study design and study limitations.
- Section 2 outlines the descriptive characteristics of the study population based on selected data (HH composition, education, crop cultivation, vanilla cultivation, assets and living standards).
- Section 3 introduces the pairs of groups we are comparing, including details on statistical analysis.
- Section 4 presents comparisons of groups based on gender (male-/female-headed HHs), market integration (contracted/non-contracted HHs) and multidimensional (MD) poverty (MD poor/ MD non-poor HHs).
- In section 5 a discussion of the findings in sections 2 and 4 is presented, with conclusions drawn and recommendations provided in section 6.

Two outstanding events make the period covered by this survey particularly interesting. First, there has been dramatic rise in vanilla prices since 2015 including price spikes that set local record prices of green vanilla (see Figure 2). Our survey covers this period (2016) retrospectively. Second, this DTBS was conducted approximately two months after the region was hit by the category 4 cyclone (Saffir–Simpson scale) ENAWO, which affected more than 200,000 people in the SAVA region (Probst et al. 2017).

1.1 The SAVA region and vanilla

The SAVA region constitutes one of the twenty-two regions of Madagascar, and is divided into 4 districts, 79 communes and 803 *Fokotany* (MINEAP 2003). The name SAVA is an abbreviation of the districts (Sambava, Antalaha, Vohemar and Andapa). It is considered home to the *Betsimisaraka* and *Tsimehety* ethnic groups, who are the majority ethnic groups in the region (Tilghman 2014). The *Sakalava* ethnic group, however, dominates the northern Vohemar district (MINEAP 2003). Due to its fertile soils and possibilities to grow cash crops and rice, the region has historically experienced immigration (MINEAP 2003). The SAVA region is predominantly Christian but there is also a substantial presence of Muslims and adherents to traditional ancestry beliefs. Often traditional beliefs are combined with Christianity (MINEAP 2003).

Madagascar is one of the “hottest biodiversity hotspots” (Myers et al. 2000, Ganzhorn et al. 2001), and the SAVA region is home to a particularly high share of endemic species (Allnutt et al. 2013). However, the region shows an alarming deforestation rate (Allnutt et al. 2013, Arruda-Ferreira 2018), and is known for illegal rosewood extraction including extraction from protected areas (Patel 2007, Randriamamonjy et al. 2016).

Vanilla was introduced to Madagascar around the year 1880 by colonial France via the neighbouring island of La Réunion. The north-eastern part of the island, today the SAVA region, became the vanilla growing region under French colonial rule due to its well adapted climate and geography. Today, the SAVA region is the largest vanilla producing area worldwide, with an estimated 70,000 smallholder farmers producing 80-90% of the Malagasy *bourbon* vanilla on ~25,000 hectares of land (ILO 2011). This has made Madagascar the producer of between 50 – 80% of all global vanilla in the past 10 years (FAOstat 2018). Currently, vanilla is Madagascar’s most important export commodity accounting for 19 % of all export value (OEC 2017).

Cultivated by smallholder farmers, vanilla farming is labour-intensive as it is produced using traditional farming methods. Without mechanisation or agricultural inputs, farmer manually clear plots, plant tutor trees and vanilla vines, weed and hand pollinate each vanilla flower.

The approach of the Malagasy government to the vanilla market has changed over the years. Through the 1970s until the early 1980s, the Malagasy government exercised a monopoly over the vanilla market. Agricultural policies emphasized state control of prices and marketing, export taxes on crops, and a protection of the domestic industries (Cadot et al. 2008). The structural adjustment policies of the World Bank from 1995 to 1997 gradually liberalized the vanilla market opening the door for competition, a diversity of actors and a free market system. This process drove up farm gate prices but has contributed to price volatility (Cadot et al. 2008). Ten years ago, the Malagasy Government’s role was restricted to setting the date of vanilla marketing, and setting sanitary and quality inspections (ibid). Currently (2018), several additional regulations exist, ranging from a prohibition of early vanilla harvesting via temporal restrictions on vanilla local transport and international exports to the restrictive issuance of export licences.

With recent dramatic increases in vanilla prices, increasing insecurity came along. Vanilla theft in the fields and in the curing process have become a wide spread problem in the region (see section 4.8 below). Consequently, many farmers spend substantial resources during the last two to three months before harvest guarding their fields against thieves and robbers. Alternatively, farmers harvest immature vanilla in order to reduce the risk of theft affecting negatively on the quality of the product.

These present major challenges for smallholder farmers of whom the large majority depend on an informal vanilla market beleaguered by a multiplicity of middlemen (Packer 2008, Fairfood International 2014). Other challenges include the complex production cycle[1] of vanilla and climate-related disasters as the region is regularly hit by cyclones. These repeating devastations to vanilla fields impact the global vanilla supply and have global impact on its prices (Brown 2007). In 2003, long droughts across Madagascar followed by a devastating cyclone affected local production – even wiping out much of the warehouse stock. This caused a boom in prices, which was immediately followed by a dramatic price bust (see Figure 2).

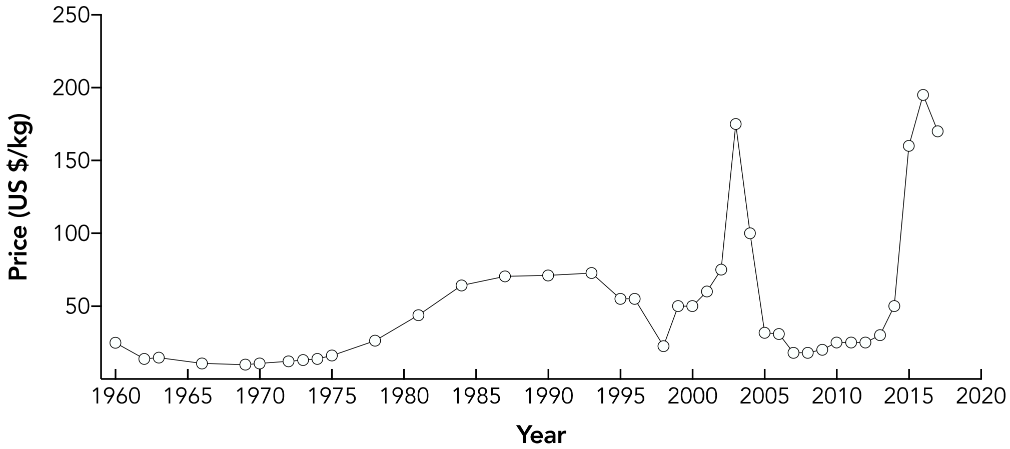

Figure 2: Local prices of black vanilla in Sambava between 1960-2017, Source: DRAE 2018

Following the price spike in 2002-2003, an increasing number of national exporters and international flavour houses started CFAs with vanilla producers. Such agreements were virtually absent in the vanilla sector prior to this price spike (Packer 2008, Sielaff et al. 2014). As we will see, 15% of all vanilla farmers in our study region are in CFAs with an exporter, collector or other formal business partner today (see Figure 4). A few international flavour houses have established sourcing centres in the SAVA Region. They are either competing or

[1] When vanilla plants are destroyed by cyclones, farmers can only harvest again 3 years after replanting vanilla vines

partnering with traditional collectors, importers and exporters. Contracted vanilla farmers receive a varying combination of benefits. The benefits can include price premiums, access to credit, support for income diversification, technical assistance, vocational training, educational support and free health insurances.

The impact of this current shift in vanilla sourcing for both local livelihoods and the regional biodiversity is the central focus of our research project. We ask on the one hand, who are the vanilla farming HHs that benefit from such CFAs? Are benefits evenly distributed among the local population? Are inequalities in - and between households and villages amplified? Are certain social groups excluded and are dependencies between small-scale farmers and companies reinforced? On the other hand, we investigate through an ecological lens what is the value of vanilla plots for biodiversity and can vanilla farming contribute to the conservation of biodiversity on a regional scale?

1.2. Explorative phase prior to baseline survey

The research team (Ph.D. and master students instructed by Dr. Yvonne Franke) conducted an explorative research phase from October - December 2016. Adopting the methodology of a transdisciplinary approach, the main objective of this phase was to build a research agenda that reflected the interest and priorities of stakeholders. With that aim, we conducted twelve semi-structured expert interviews with stakeholders of the vanilla value chain (farmers, collectors and exporters), government officials and Non-Governmental Organizations (NGOs). Additionally, we organized two focus group discussions with vanilla farmers in two different villages. Reflecting the interdisciplinary nature of the research team, the interviews and workshops considered the interaction of socio-economic and biological factors.

The team analysed the data by applying a content analysis approach following Meuser and Nagel (2002). The interview material was jointly discussed. Core insights were visualised in seven problem-centred mind maps and subsequently discussed in a stakeholder meeting. As a point in case, we are following the idea to communicatively validate our findings with the non-academic partners of the research project, which is a common tool in transdisciplinary research (Brandt et al. 2013).

The qualitative phase provided insights on the needs and problems that stakeholders and, particularly, smallholder farmers currently face. These so-called "real-world-problems", as dubbed in transdisciplinary research approaches were framed into questions for the baseline questionnaire (cf. Hirsch Hadorn et al. 2008). A central topic of interest for farmers, and nearly all Work-packages (WPs), included vanilla theft. Thus, the DTSB assessed the number of HHs affected by theft and the amount of vanilla stolen (see results section 4.9 Vanilla theft). Other important issues emerging from the explorative field phase where the perceptions of additional benefits offered by corporate buyers, motivations to associate as farmer groups and land use practices. Besides the issues of general interest, the explorative phase helped each WP to clarify (proxy) questions, which addressed their specific concerns and interests.

1.3 Study region and sampling design

After key informant interviews between the lead author and vanilla exporters and traders, government officials and NGOs in May-June 2016, our study region was confined to the core vanilla region inside the SAVA region (see Figure 3)[2]. The regions and villages inside the SAVA that were chosen were those where most vanilla is sourced from and where CFAs between vanilla buyers and vanilla farmers were found in 2016. The region represents not only and interesting study region for the impact of CFAs on the livelihoods of vanilla famers, but also for both, biodiversity and social diversity. In fact, it is one of the most biodiverse areas globally (Allnutt et al. 2013) and our chosen study villages differ socio-economically. The villages differ in size, geography, market access, vanilla business relations and general infrastructure.

However, due to logistic constraints, we set the limit of our study area to villages up to 10 km away from primary, secondary or tertiary roads (see Figure 3). Still, some of the study villages covered are only accessible by pirogue and/or motorbike. During the rainy season, however, some of these villages are only accessible by foot.

Prior to the DTBS, information on our studied villages (sizes, locations, characteristics), population demographics and local livelihoods was extremely scarce. Consequently, all villages <10 km from primary, secondary and tertiary roads were systematically visited and recorded through GPS devices (n= 323, see grey dots in Figure 3 for all villages covered). Subsequently, we conducted a rapid survey with the *chef du village* to cover the village size, demographics, infrastructure as well as corporate affiliation of regular vanilla buyers. Addressed questions included:

-How many men, women and children live in the village?

[2] The vanilla growing region continues down to Maroantstetra (south of Antalaha), where a track can be walked in 2-3 days. Likewise, west of Sambava and Antalaha, and a bit north of our study region, vanilla is also cultivated according to local experts.

-Who are the main buyers of vanilla?

-Are there vanilla contracts or private voluntary standards in place?

-Are NGOs working in these villages?

-Are there schools, health centres, cooperatives and associations and other farmer organizations?"

In 216 villages, no CFAs were reported to exist while the presence of CFAs were claimed in 107 villages (*ex-ante* data on CFA presence). The standards in use and secured via CFAs are mainly Rainforest Alliance, and various Fair Trade and Organic standards (see above for a clarification of private voluntarily standards). Sampled villages in the pre-survey cover a total population of around 156,000 inhabitants in total (including children). In addition, we received (i.) population lists (inhabitants >18 years old)[3] and (ii.) collected producers lists. Producer lists are lists of vanilla producers, which are organized for or by companies/certifiers in associations or other farmer organizations.

Village selection was done through a stratified random sample as we wanted to sample different village sizes evenly distributed (see Table 3). This led to a sample of 30 villages where *ex-ante* no CFAs with vanilla farmers existed and 30 villages where CFAs *ex-ante* did exist.

Table 3: Village and household selection

Villages			
30 villages with households in CFAs		**30 villages without households in CFAs**	
Inhabitants	**N**	**Inhabitants**	**N**
0-1000	6	0-1000	6
1001-2000	6	1001-2000	6
2001-3000	6	2001-3000	6
3001-4000	6	3001-4000	6
>4000	6	>4000	6
Sum	**30**	**Sum**	**30**
Households			
-15 random chosen from population list -15 random chosen from producers list		-30 random chosen from population list	

In villages where (i.) CFAs were *ex-ante* absent, 30 households were randomly sampled from a population list. We also sampled (ii.) 30 villages where CFAs were *ex-ante* present. Here, we sampled 15 households per village randomly from the population list and 15 randomly from the producers list, respectively.

[3] Election lists were crosschecked with the *chef du village*. If the *chef du village* had updated lists of his village, we sampled directly from the latest population list *in situ*. However, we have reason to believe that our sampling protocol was not followed strictly enough in at least 8 villages. Please see the corrigendum in the beginning of this document.

When different producer lists existed in one village, we pooled the producers lists into a single list for subsequent HH selection. Sampled HHs from producers´ lists are more likely to have entered CFAs, to produce certified vanilla, or are in the certification process (n= 450). In effect, HHs with CFAs are oversampled by a factor of 2.3 (see Table 9) justified by the central Diversity Turn research interest in CFAs/vertical integration impacts.

Finally, the DTBS includes a sample of 1,350 randomly selected, representative HHs, and 450 HHs chosen randomly from producer lists (non-representative). To balance both, village as well as household samples, sampling weights are presented in Appendix 2 and Appendix 3 for village stratification; see also Equation 1 how they have been calculated.

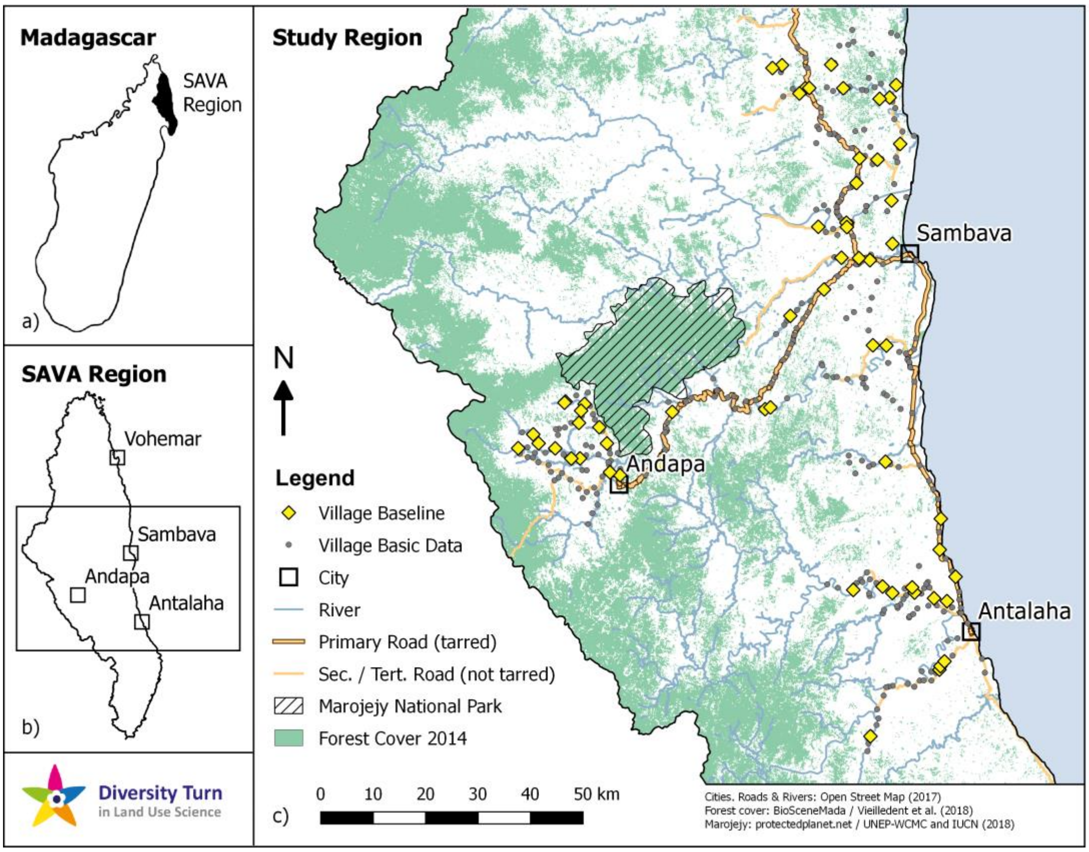

Figure 3: Panel of maps of a) the location of the SAVA region within Madagascar, b) the location of our study region within the SAVA region and c) the study region. Map c) shows the 60 villages where the baseline survey was conducted (yellow diamonds) and the 323 villages which were pre-surveyed (grey dots). Map c) additionally shows the three largest cities, rivers, primary, secondary and tertiary roads, Marojejy National Park and forest cover within the study region.

1.4 Limitations and constraints

As in all surveys, questions and answers can be influenced by both interviewers and respondent biases. Respondents might not feel comfortable and/or not answer sensitive questions, such as illiteracy or their vanilla business relations, among others. Therefore, respondents were informed that they had the possibility not to answer, that the data is treated anonymously and that they could terminate the interview at anytime. Respondents may also have wrong expectations knowing that foreigners were implementing the survey, e.g., over-reporting vanilla theft in hope to attract support. Particularly quantitative, open questions have sometimes been difficult for respondents to answer accurately. To facilitate valid responses, farmers had the choice, for example, to answer questions on the quantity of vanilla losses or of vanilla theft in either in kilograms or percentages. The answers to the following questions are the most likely to be limited:

- sizes of agricultural fields (including vanilla fields) as they are not precisely measured and instead self-estimated,
- labour (particularly child labour),
- vanilla theft, and
- premature vanilla harvesting and sale

In Section 4, we compare male- and female-headed HHs. However, we cannot cover the entire gender complexity by this survey. As our unit of analysis is the HH, consisting of both males and females, an intra-household comparison was not aimed at and, consequently, cannot be performed. In effect, gender biases are only covered through differences in HH heads (male/female), which prevent holistic gender comparisons.

Moreover, the study region we choose is the region where most vanilla sourcing takes place and where most CFAs have been found in 2016. However, vanilla cultivation can be found in very remote areas in the SAVA region as well, that is, areas, that are only accessible by more than 10km of several days of walking and/or pirogue trips on rivers or outside of the core vanilla growing areas. These areas are not covered by our survey and, therefore, we cannot provide information on these areas.

1.5 Tools and data collection

Data collection for the baseline survey took place between April and June 2017. The database was prepared through XLS programming (see xlsform.org) and we used tablets (Lenovo Yoga Tab 3) equipped with the KoboCollect software (see kobotoolbox.org).

The baseline data was collected with the support of 20 student assistants (10 female, 10 male) from the regional *Centre Universitaire de la SAVA* (CURSA), which is based in Antalaha. The 20 CURSA students were grouped into teams of five, with one additional non-student team leader per group. Students and supervisors received a training of 10 days by the lead author. The training included an introduction to survey technics, variable formats in questionnaires and the use of the KoboCollect application. The assistants were taught how to ask sensitive questions, to respect respondent choices on survey participation (whole survey, single questions) and on terminating an interview at any time. The questionnaire was translated into the regional dialect with the support of our local coordinators and the CURSA students. The DTBS was pre-tested in two villages (n=60 HHs) with each enumerator pre-testing the survey with three different HHs.

Data cleaning was done by the lead author with the support of an assistant. Some variables were recoded and/or grouped if the variable was open and qualitative. For numerical open questions, Grubbs outlier tests (Grubbs 1950) were conducted at $\propto = 0.05$, which control for either one-sided tests: maximum outlier values or minimum outlier values or both, that is, double-sided tests (a summary of outlier removal and data cleaning can be found in Appendix 4).

1.6 Design and structure of the questionnaire

The questionnaire design was coordinated by the lead author of the present report. However, the survey was the result of joint work with the other WPs, each of whom contributed questions according to their research interests. The questionnaire had the following sections (see Appendix 5 for the complete DTBS survey):

1. Socio-economics, demographics and education of all household members
    a. Household composition
    b. Religion, clan/ethnic affiliation, length of time in community
    c. Education and training
    d. Principal occupation
2. Agriculture (all plots excluding vanilla)
    a. Number and sizes of plots
    b. All cultivated crops
    c. The 5 most important crops (subsistence & income)
    d. Land ownership, acquisition of land
    e. Previous land use before agriculture
3. Vanilla plots, management and production (time reference = past 3 years)
    a. Number and sizes of plots
    b. Land ownership, acquisition of land
    c. Previous land use before vanilla cultivation
    d. Shading level of plot
    e. Age of the fields
    f. Number of vanilla vines on the field
    g. Production of (green and black) vanilla
    h. How many vanilla vines have been added in the past 3 years?
    i. Have the fields been reduced or enlarged?
    j. Diseases

4. Labour utilisation and expenses
    a. In which months is labour engaged for (i.) pollination, (ii) weeding, soil preparation, (iii.) security, and (iv.) material/other expenses
    b. Household labour for different agricultural activities (as in a.)
5. Vanilla preparation and markets
    a. Activities to avoid theft
    b. Do households cure vanilla themselves?
    c. How much vanilla is sold green and black (past 3 years)
    d. In which months is vanilla sold for which price?
    e. To whom is vanilla sold?
    f. Membership in associations/cooperatives/other farmer groups
6. Contract farming arrangements and private voluntary sustainability standards
    a. Identification of contract farming arrangements and private voluntary sustainability standards in use among vanilla farmers by distinguishing:
        i. farmers who respect a set of obligations that are typically associated with supplier contracts
        ii. farmers who respect obligations which are distinct to the Rainforest Alliance vs. Fair Trade vs. Organic standards used by some vanilla exporters to differentiate their products
    b. CFA benefits
    c. Farmer perceptions on the relative importance of CFA benefits
       Farmer perceptions on the relative importance of CFA obligations
7. Trust and perceptions of crime
    a. Measures of trust-levels on the following groups: (i.) village/community actors, (ii) ethnic groups, (iii) police and (ii.) collectors/ enterprises.
    b. Fear of crime
8. Living standards / Assets
    a. Diseases/mortality in the household
    b. Electricity
    c. Sanitation/drinking water
    d. Fixation (material) of house
    e. Possession of other assets
9. Income and livelihood diversification
    a. Importance of income from livestock and forest products
    b. Forest products that are (i.) used and (ii.) sold
10. Livestock
    a. Livestock assets
    b. Reasons for keeping livestock
11. Impact of the cyclone *ENAWO*
    a. Share of households damaged
    b. Description of the cyclone damage

2. DESCRIPTIVE RESULTS

2.0 Introduction Results Sections

This is the first of two results sections. In this section, we present selected descriptive statistics of the sample of randomly selected HHs (n=1350) representing the study region.

Generally, all presented values indicate mean values ± 1 Standard Error, if not otherwise mentioned.

2.1 Sample composition with respect to variables of particular interest ("key variables")

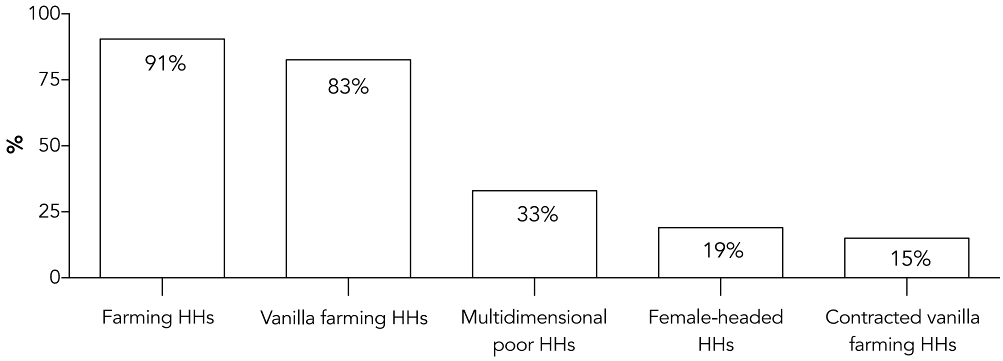

Figure 4: Frequencies (%) of different household groups in representative sample, N= 1350

Of the 1350 sampled HHs, 91.0 % farm crops and 82.6 % also produce vanilla. A third (33%) of the HHs are MD poor. Nearly a fifth (19%) of sampled HHs are female-headed, of which ~12 % are divorced, 5% are widowed and 2% are living without a male partner and heading the HH due to other reasons. Among the HHs that farm vanilla, 15% are in a contract farming arrangement (CFA) with a vanilla exporter, collector or vanilla preparator.

MD poor and contracted HHs, will be used in group comparisons in Section 4.

2.2 Socio-economic and socio-demographic background

2.2.1 Household size & composition

The 1,350 sampled HHs consist of 6,476 individuals. In our sample, males (n= 3,219) are slightly less represented than females (n= 3,257). The population is young with 50.2 % of sampled individuals being <18 years old. Females were, on average, 21.7 ± 0.37 years old and males 16.1 ± 0.29, respectively. The average household size is 4.74 ± 0.61 (min: 1, max: 17). Table 4 shows the distribution of HH members.

Table 4: Household demographics, n=1329*

Relation to HH head	N	Persons living in average HH	Age (average)	St. error mean
Household head (male/female)	1329	1.00	49.45	1.49
Wife/husband	1061	0.80	40.26	0.41
Son	1468	1.10	13.85	0.23
Daughter	1389	1.05	13.41	0.38
Father	19	0.01	73.48	5.40
Mother	33	0.02	69.07	3.46
Grand-son	457	0.34	9.44	0.27
Grand-daughter	395	0.30	9.19	0.30
Non-family male	82	0.06	45.22	24.15
Non-family female	64	0.05	15.16	1.64

**21 respondents did not report detailed demographics and only gave HH size*

The average age of the HH head (both, male and female) is 49.5 years, with an average age difference between HH head and spouse of 9.2 years. Nineteen percent of the HHs are female-headed, living without male partner and 1% of male-headed HHs live without a female partner. HHs with at least one responsible adult person (HH head) constituted 20% of the sample, while the remaining 80% were represented by HHs with two responsible adults (HH head and spouse). The average HHs has 1.1 $\pm$ 0.2 sons living in the HH and 1.1 $\pm$ 0.4 daughters, with an average age of 13.9 and 13.4, respectively. It is uncommon to have the father/mother of the HH head or non-family members residing in the HH. However, having grandsons (0.3 $\pm$ 0.3 per HH) or granddaughters (0.3 $\pm$ 0.3 per HH) residing in the HH is not uncommon.

2.2.2 Literacy I: Malagasy

Respondents were asked if their HH members know how to write and read in Malagasy.

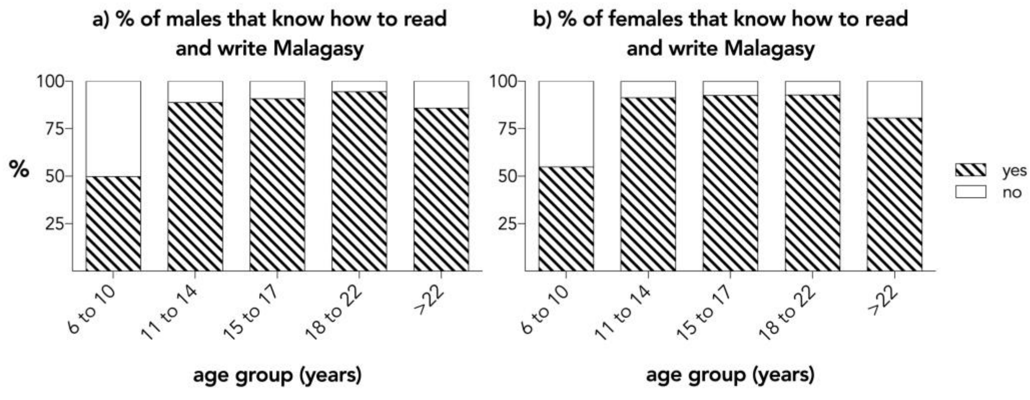

Figure 5: Malagasy literacy a.) male, n=2842 and b.) female, n=2861

Approximately 50% of the children of primary school age (6-10) are reported to be able to read and write Malagasy (girls: 54.9%, boys: 49.8%). Among children and youths aged between 11 and 22, 88.9% – 94.5% can read and write Malagasy reportedly. For adults older than 22 years, there are slightly more men (85.8%) than women (80.7%) with Malagasy literacy.

2.2.3 Literacy II: French

Respondents were asked if their HH members know how to to speak, read and write in French.

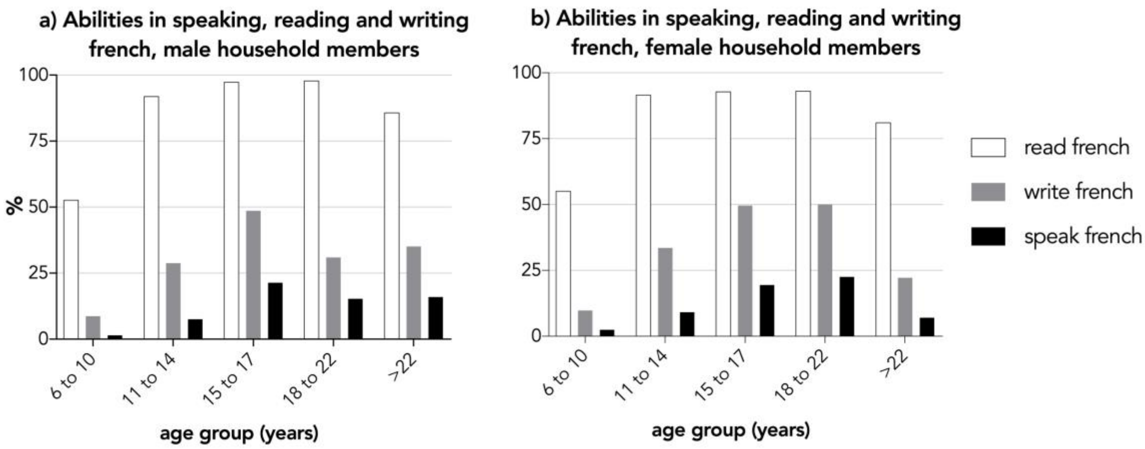

Figure 6: Abilities in reading, writing and speaking French a.) male (n=2842) and b.) female, n= 2861

As we see in Figure 6, males and females show virtually similar patterns, with only minor differences, in French literacy skills. Most inhabitants know how to read in French, which is most evident when considering males and females over the age of 11 years old. For the first age groups, French language skills increase with age, however, they decrease for the population older than 18 (males) and 22 years old (females). All in all, reading French appears easier than writing it, with speaking appearing to be the most difficult skill to achieve.

2.2.4 School certificates by gender and age group

Respondents were asked if their HH members have any school certificates and could choose between the following options: (i.) school certificate from primary school, school certificate after five years of schooling: *Certificat d'Étude Primaire Élémentaire* (CEPE), (ii.) school certificate from lower secondary school (*Collège d'Enseignement Générale*), after 4 additional years of schooling: *Brevet d'Étude Primaire Complémentaire* (BEPC), (iii.) school certificate from upper secondary school (*Lycée*), school certificate after 3 additional years of schooling: *Baccalauréat* (BACC).

Concerning HH members >18 years old, males received 5.24 ± 0.69 years of schooling, on average, compared to 4.76 ± 0.61 years of schooling for females.

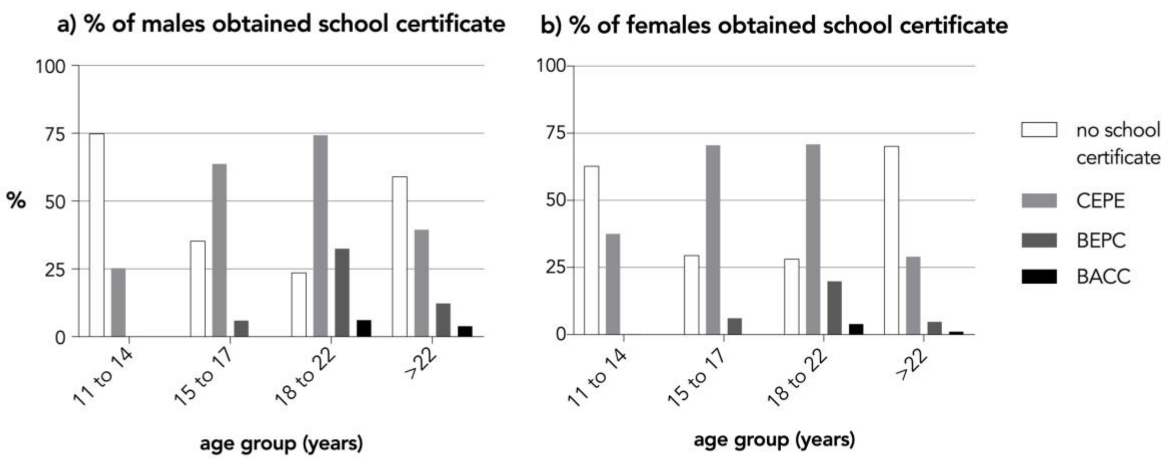

Figure 7: School certificates obtained by a) male household members & b) female household members

A high number of children aged between 11 and 14 years old do not have a school certificate (males: 75%, females: 63%). The older the children/youths (11-22 years of age) are, the lower the percentage is of those without school certificates. Most HH members aged between 18 and 22 years old, have a CEPE (males: 74%, females 71%). However, most of the adults >22 years do not have a school certificate. Among this group, a lack of school certificate is higher amongst females (70%) than males (59%).

2.2.5 Professional training

Apart from school education, respondents were asked if they have any formal vocational training including a certificate or diploma.

Table 5: Professional formation by a.) all household members > 18 years, and b.) household heads

Formation	a) All HH members (≥18 years old)				b) HH head			
	Male		Female		Male		Female	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
No formation at all	1454	85.6	1598	93.9	854	79.8	221	85.3
Agricultural training by NGO/enterprise	149	8.8	71	4.2	135	12.6	26	10.0
Teacher	33	1.0	14	0.4	24	2.2	4	1.5
Military	15	0.9	0	0.0	14	1.3	0	0.0
Other	216	6.7	94	2.9	193	18.0	34	13.1
Total	1867	100.0	1777	100.0	1220	100.0	285	100.0

Around 94% of all females ≥18 years old don´t have any professional formation compared to

85.6% of males. This number is slightly lower amongst the HH heads (males: 79.8%, females: 85.3%). Concerning HH members ≥18 years old, examples of the professional formations mentioned include teacher formation (males: 1%, females: 0.4%), agricultural trainings by NGOs or enterprises (males: 8,8%, females: 4,2%) and military formation (males: 0,9%, females: 0%).

2.2.6 Principal Occupation

Respondents were asked what the principal occupation of (a) the HH head is and (b) all HH members. Only one answer was possible.

Table 6: Principal occupation of (a.) household members ≥18 years and (b.) household heads*

Principal occupation	All HH member (≥18 years old)		HH head	
	Frequency	Percent	Frequency	Percent
Self-employment in agriculture	2699	80.2	1245	92.4
Civil servant/Government official	47	1.4	22	1.6
Entrepreneurs (other than farming)	38	1.1	9	0.7
Student (school or university)	136	4.0	21	1.6
Retired/not able to work	76	2.3	20	1.5
Unemployed, looking for work	60	1.8	3	0.2
Other	311	10.2	27	2.0
Total	3367	100.0	1347	100.0

**3 respondents did not answer. Only activities cited by at least 10 respondents in of both categories is presented, the rest is summarized in "other"*

Table 6 shows results of HH members ≥ 18 years old only. Large numbers of respondents (80.2 % of all adults and 92.4% of HH heads) cited self-employment in agriculture as their principal occupation. A small number of civil servants (1.4 % of adult HH members and 1.6 % of HH heads) and very few entrepreneurs (1.1% of all adults and 0.7% of HH heads, respectively) exist in the sampled population. Of the HH members ≥ 18 years old, 4% are students at school or university, while the figure is 1.6% for HH heads. Less than 20% of HH members ≥ 18 years old and 10% of HH heads are involved in non-agricultural related activities.

2.2.7 Additional income-generating activities to principal occupation

Respondents were asked what kind of income sources the HH members have in addition to their principal occupation (above), multiple answers were possible.

Table 7: Additional income sources to principal occupation, for a.) household members > 18 years and b.) household heads*

Activity	a) All HH member (≥18 years old)		b) HH head	
	Frequency	Percent	Frequency	Percent
None	2574	75.4	885	66.6
Little business at market (*PPN*, *friperie*)	159	4.7	54	4.1
Commissionaire of vanilla	87	2.5	77	5.8
Tailor	61	1.8	12	0.9
Handicraft	59	1.7	23	1.7
House construction	55	1.6	44	3.3
Carpentry (furniture etc.)	47	1.4	35	2.6
Little businesses (kiosk, *gargotte*)	47	1.4	19	1.4
Vanilla collector	17	0.5	13	1.0
other	309	9.0	167	12.6
Total	3415	100.0	1329	100.0

**21 respondents did not answer. Only activities cited by at least 10 respondents were presented, the rest is summarized in "other".*

Seventy-five percent of the surveyed population (≥ 18 years old) indicate that they do not have any other income-generating activity than farming; the same applies to 66.6% of HH heads (Table 7). The most important additional income source to farming for HH heads is to engage in little businesses at markets (4.1% of HH heads, 4.7% of all HH members ≥18 years old). HH heads are also engaged in the trade of vanilla: 5.8% work as commission agents and 1.0% as vanilla collectors; the percentage is lower for all HH members ≥18 years old.
Likewise, house construction is cited by 3.3% of HH heads, as well as carpeting (2.6%).
Petty trade, such as running a village kiosk or local *gargotte* (food stands) is cited by 1.4% of HH heads and HH members >18 years old.

2.3 Agriculture and crops

2.3.1 Most important subsistence crops and cash crops

A large share (90.5 %) of the surveyed HHs farm crops other than vanilla (see section 2.4 for the vanilla survey). Farming HHs have, on average, 1.7 ± 0.3 agricultural fields.

Respondent HHs were asked to name the 5 most important (a.) subsistence crops and (b.) the 5 most important cash crops that they are farming (Figure 8).

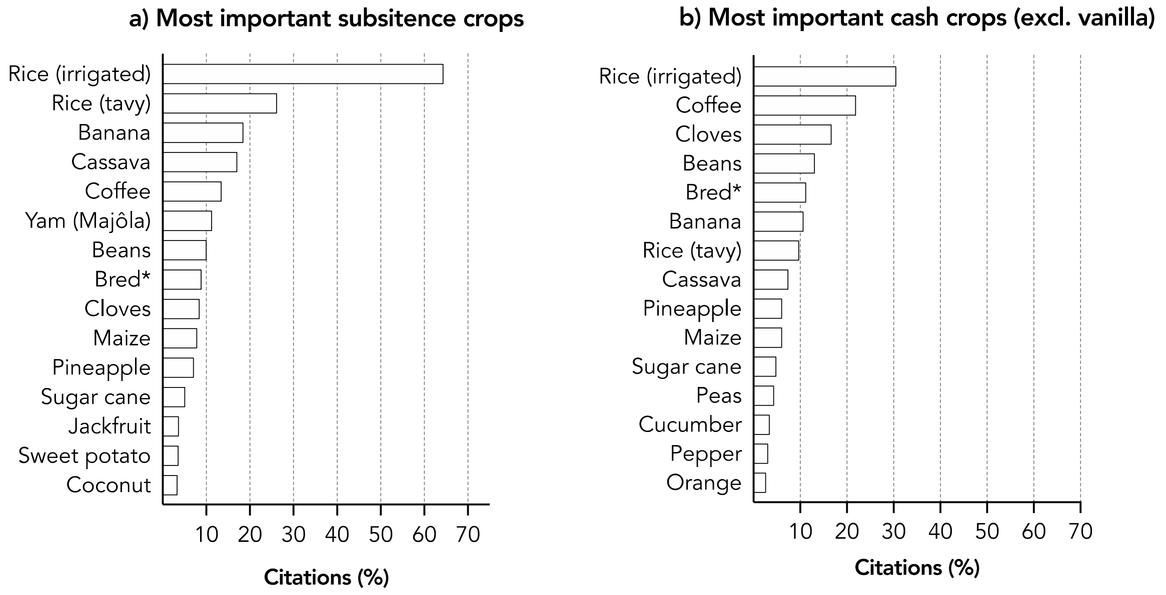

Figure 8: % of respondents citing crop among the 5 most important a) subsistence crops, b) cash crops, n=1350

Rice is the most important staple and subsistence crop in the region (90.4% in sum) and is farmed in two ways: as irrigated rice and as hill rice (*tavy*[4]). While rice from hill rice (*tavy*) production is mainly a subsistence crop and is barely cited as a cash crop, irrigated rice is cited as both an important cash (30.5%) and subsistence crop (64.3%, compare Figure 8a and b). Other often cited subsistence crops include banana (18.4 %), cassava (17.0%), coffee (13.5%), yams (11.3%), beans (10.0%) and bred[5] (8.8%).

Coffee is the second most cited cash crop (21.9 %) followed by cloves (16.6 %), beans (13.0%) and bred (11.2%).

---

[4] Tavy is a traditional upland rice production system, particularly used in in tropical eastern Madagascar. Forest is burnt, and rice is planted; in succeeding years rice or other crops are planted again. However, soil is depleted usually after 3 – 5 years. Subsequently, more forest is burnt (Moser 2008).

[5] Bred refers to Bred mafana (*Acmella oleracea*), which is often cooked together with cassava leaves.

2.3.2 Land ownership of agricultural fields (excluding vanilla)

Respondents were asked which member of the family owns the plot, i.e. does the HH head, another relative or a non-family member own the plot.

Figure 9: Land ownership of agricultural fields in relation to household head, n=1984

Just under two thirds (61%) of the plots are owned by the HH head. However, it is relatively common that the land is owned by another family member including or his/her wife/husband (25.2% in sum). Only 0.6% of the plots belong to non-family members.

2.4 Vanilla farming

2.4.1 Ownership of vanilla plots

Respondents were asked who the owner of the vanilla plots used by the HH is.

Figure 10: Ownership of vanilla plots in relation to household head (n=1462)

Of the HHs surveyed, 82.6 % practice vanilla farming and 63% of all the vanilla plots are owned by the HH head. Other substantial owners are the parents (17.2%) and spouses of HH heads (10.5%). Only 0.2% are owned by non-family members.

2.4.2 Acquisition of vanilla plots

Respondents were asked how the land for vanilla plantations was acquired

Figure 11: Land acquisition of vanilla plots (n=1613)

The majority (64%) of HHs inherited the land from other family members. Almost a quarter (24%) of HHs bought the land and 8.0% of HHs acquired the land through making the forest farmable, i.e. '*cutting the forest'*. Less than 1% of HHs received the land through marriage, 0.9 % received it as a present and 0.6 % borrow the land.

2.4.3 Land use before vanilla cultivation

Respondents were asked how the land was used before vanilla plantation.

Figure 12: Land use before vanilla cultivation (n=1613)

According to respondents, 18.3% of the land was already a vanilla plantation before the respective HHs started to farm vanilla, 30.6% of the current vanilla plots were previously fallow land and 22.3% were previously forest. Other cultures (8.9%), hill rice fields (*tavy*, 8.8%) and coffee plantations (8.6%) were also cited frequently.

2.4.4 Use of family labour in vanilla cropping

Respondents were asked which members of the HH contribute to the different agricultural activities in vanilla cropping.

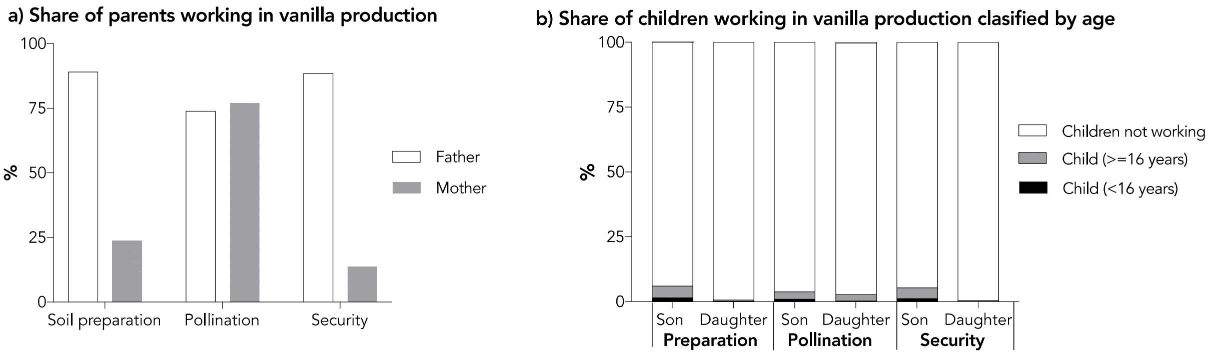

Figure 13: Use of family labour and infra-family labour contributions in vanilla cropping, % household member was mentioned for a) father/mother (n=1115), b) share of children divided into >16 years old and <16 years old

The security of the vanilla fields, i.e. protection and surveillance against theft, is mainly done by the father of the family (88.4%) compared to mothers (13.6%). Numbers are similar for soil preparation (89.1% vs. 23.7%). Vanilla pollination is practiced slightly more often by mothers (77.0%) compared to fathers (73.9%).

Children are only included in the analysis for the vanilla producing HHs (n=1115) and if children were listed as HH members (n=2249; Figure 13b). For children younger than 16 years old, respondents report that 1.4% of sons help in soil preparation compared to 0.1% of daughters. Reportedly, they rarely work in pollination (0.9% sons, 0.3% daughters) and none of the young daughters work in security, while 1.2% of the sons were reported to do so. Concerning children 16 years and older, 4.6% of sons work in soil preparation compared to 0.5% of daughters. This pattern is similar for securing vanilla fields. However, rates are higher in pollination with 2.8% of sons and 2.4% of daughters assisting in the pollination process, respectively.

2.4.5 Prices received for green and black vanilla in 2016/2017

Respondents were asked in which month they sold green and/or black vanilla, and what prices they received in 2016 and 2017 - up to the date of the survey (April 2017). Figure 14a and b are chronologically presented differently as the black vanilla self-prepared and sold in 2017 is the same harvest as the green vanilla from 2016.

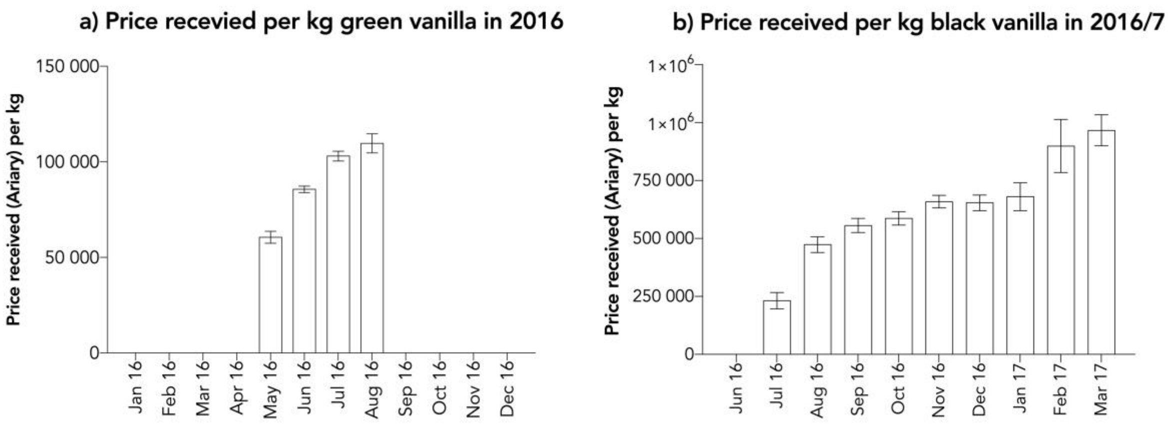

Figure 14: Price received for a) green vanilla (n=885) in 2016 and b) black vanilla (n=496) in 2016/7. Mean +/- 1 Standard Error. On the 1st of July 2016 ,1 € was 3,561 Ariary.

As we see in Figure 14a, prices for green vanilla go up steadily from May in 2016 (60,600 $\pm$ 3,200 Ariary) and reach their maximum in August (109,600 $\pm$ 4,800 Ariary).

Farmers who cure, ferment and prepare green vanilla into black vanilla, sold black vanilla from July 2016. However, the prices varied greatly (Figure 14b). Prices start at 232,000 $\pm$ 36,000 Ariary in July 2016 and steadily increase until March 2017, reaching a mean value close to 1 million Ariary (967,000), i.e., more than 4 times higher than in July 2016.

The fairly low standard errors indicate a high confidence at relatively low levels of variation within the research region.

2.5 Household assets and wealth

2.5.1 Energy sources

Respondents were asked if the HH has a source of electricity at home, whether it is self sufficient or shared with other HHs (see Figure 15), and what the energy sources used for cooking are at home (Figure 16).

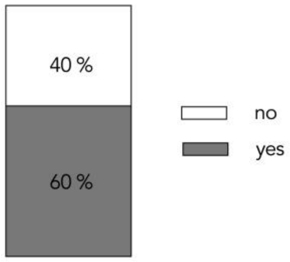

Figure 15: Electricity at home

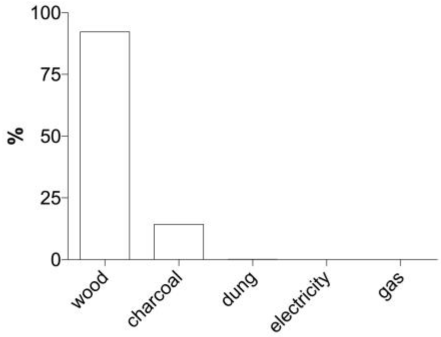

Figure 16: Energy sources used for cooking

Almost two thirds (60%) of the HHs have access to electricity at home, while 40 % do not. Only one of our studied villages is connected to an electricity grid. The most common source of electricity are solar panels and generators (own survey data). For cooking at home, almost exclusively wood (92.2%) and charcoal (14.2%) are used (see Figure 16). Electricity and gas are not used by any of the surveyed HHs.

2.5.2 Drinking water/sanitation

Respondents were asked (i.) how long they walk to the closest water source, (ii.) if they have access to a latrine[6] or toilet and (iii.) if the latrine/toilet is shared with other neighbours.

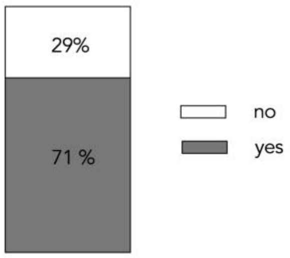

Figure 17: % of households having access to a latrine (n=1350)

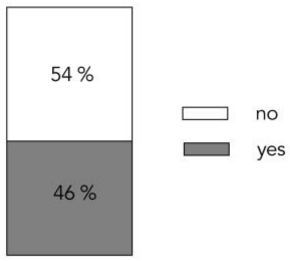

Figure 18: of households sharing latrine with neighbours (n=959)

[6] A latrine is a simple toilet facility, e.g., a trench in the earth or a hole in the ground, which can be fixed with wood or other material. Latrines sometimes have platforms with wood or earth.

Local inhabitants walk on average 7.6 ± 0.22 minutes to the closest water source (Min: 0, Max: 80 min.). Seventy-one percent of surveyed HHs have access to a latrine. Among these HHs that have access, 46% share the latrine with neighbours or other HHs.

2.5.3 Foundation of houses

Respondents were asked what material makes up the foundation of the HH´s house.

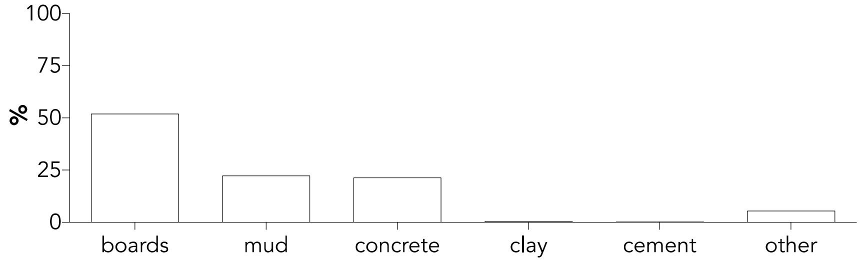

Figure 19: Foundation of houses, n=1350

Wooden boards are the most commonly used as the foundation of houses (51.9%), followed by mud (22.3%) and concrete (21.3%). Clay (0.4 %) and cement (0.2 %) are barely used as materials for house foundations.

2.5.4 Livestock ownership

Respondents were asked if they possess any livestock, and, if so, how many different types of livestock they possess.

Table 8: Livestock holdings per HH and per livestock type

Livestock class	a) % of HHs owning livestock class	b) Number of animals				
		N	Min	Max	Mean	Std. Dev.
Chickens	70.8	966	1	300	14.19	17.44
Zebus	42.9	581	1	35	3.73	3.21
Other poultry	21.1	286	1	42	7.76	6.59
Pigs	12.7	174	1	10	2.29	1.67
Bees (No colonies)	0.5	7	1	300	46.29	111.97

Chickens are the most frequently kept animals, with 70.8% of HHs owning chickens. Zebus are also common with 42.9% of HHs owning such livestock. Other poultry (mainly ducks) and pigs are less common, with 21.1% and 12.7% of HHs owing them (see Table 8a). In Table 8b, the numbers of each livestock are presented, whereas only HHs that possess livestock are included.

HHs that own chickens, have 14.2 chickens on average. The quantities are less for other poultry (7.8), zebus (3.7) and pigs (2.3 on average). Bees are only kept by 7 of the surveyed HHs.

2.5.5 Ownership of other assets

Respondents were asked which of the following items the HH possesses.

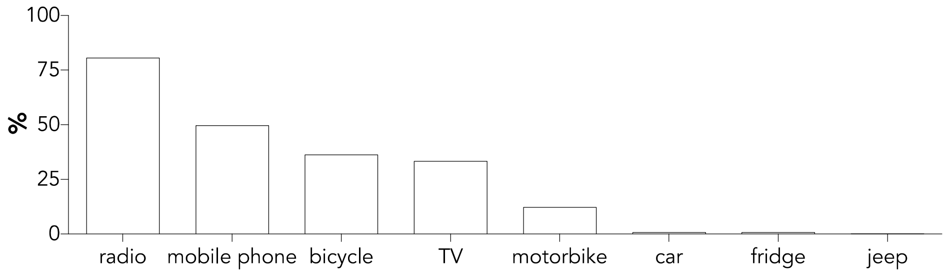

Figure 20: % of households owning "other assets", n=1350

Large quantities of HHs (80.5%) possess a radio, 49.6% possess a mobile phone and 36.6% possess a bicycle. Similarly, TVs are relatively spread, with 33.3% of all HHs owning one. However, motorbikes are less common (12.2%), and cars, fridges and jeeps (4WD) are owned by less than 1% of the surveyed HHs.

2.6 Impact of the cyclone ENAWO

Respondents were asked (i) if the HH was impacted by the cyclone ENAWO and, if so, (ii) what type of damage was caused. Multiple answers were possible.

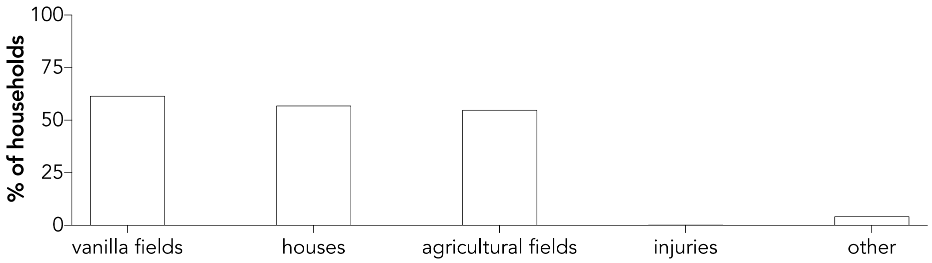

Figure 21: % of households impacted by the cyclone ENAWO, n=1350

The vast majority (89.2%) of HHs reported that they were impacted by the cyclone (Figure 21). It was reported that 61.4% had damage to their vanilla plots, 56.7% to their houses and 54.8% to non-vanilla agricultural fields. Only 0.2% of HHs were injured.

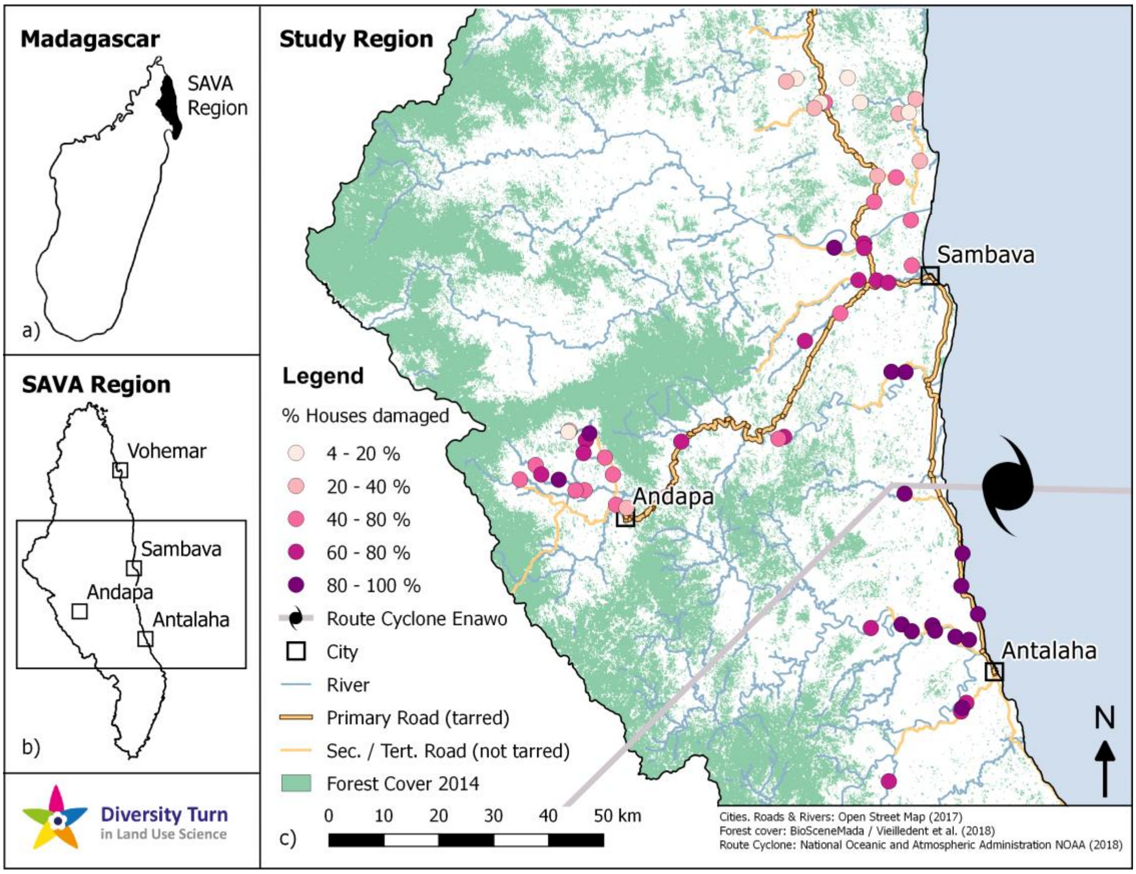

Figure 22: % of households with damages to their houses through the cyclone ENAWO

Figure 22 shows the spatial impact of cyclone ENAWO on HH´s houses in all study villages (n=60). The rate of damage is as high as 100% in some villages close to the core of the cyclone (south-east) and as low as 4% in villages further away (west and north). Damage may either be caused through wind or flood.

3. GROUP COMPARISONS

3.1 Introduction to the group comparisons

In this section, we compare 3 different pairs of groups: (i.) male- vs. female-headed HHs, (ii.) multidimensionally (MD) poor vs. MD non-poor HHs, and (iii.) contracted vs. non-contracted HHs.

(i.) Male-headed HHs have a male person as the head of the HH. On the contrary, female-headed HHs have a female person as the head of the HH. That is, the female-head lives without a partner, is widowed or divorced. (ii.) Contracted HHs are vanilla farming HHs that have a contract with a collector, exporter or another business partner, usually beyond spot markets (see above). Non-contracted HHs do not have any contracts and mostly depend on the informal vanilla spot market. (iii.) MD poor HHs are identified through the MPI, i.e. indicators of health, education and living standards, see above.

The samples of groups i. and ii. and iv. are based on the random sample (N=1350). Comparatively, the sampled HHs from producer lists (N=450) for group iii. were only included if they were in fact identified as having a CFA through the DTBS survey. This was based on questions of obligations and benefits from contract partners (see Q. 20-24 in DTBS Appendix 5: DTBS questionnaire). Of the 450 sampled HHs from the producer lists, 157 were identified as contracted.

Likewise, for several group comparisons only those HHs who do farm vanilla are included (e.g. field size, vanilla harvests, sale of vanilla etc.) as not all sampled HHs farm vanilla (see group iv. in Table 9). Similarly, not all vanilla farming HHs sell green and/or black vanilla.

Therefore, the number of observations can differ; the actual number of observations is indicated in the beginning of each section as well as in the respective tables and figures.

As the sample sizes for the pairs of groups we are comparing are unevenly distributed, sampling weights are presented in Table 9 so that we are able to present representative findings for the sampled population (see also Equation 1 how they have been calculated).

3.2 Statistical Analysis

In order to test if there are significant differences between different groups (i.e., (i.) male- vs. female-headed HHs, (ii.) MD poor vs. MD non-poor HHs, and (iii.) contracted vs. non-contracted HHs), we conducted t-tests if the analysed variable was scaled/metric. However, t-tests were only conducted if (a.) the data analysed was normally distributed and (b.) assumptions of homoscedasticity were met, that is, if variances of the different groups were homogenously distributed (Sheskin 2004). Normal distribution of scaled/metric variables were tested through Shapiro-Wilk tests (Shapiro and Wilk 1965), and homogenous distribution of variances through Levene´s tests (Levene 1960).

If the analysed data was not normally distributed and/or assumptions of homoscedasticity were not met, we opted for non-parametric Mann Whitney tests instead of t-tests (Sheskin 2004).

For categorical data, on the other hand, we applied χ^2 tests to test for independency in contingency tables, i.e. significant differences between the groups (Agresti 2007). If the χ^2 test displayed overall statistical significant differences between the groups, we also applied Fisher's exact tests so as to uncover where exactly the differences are (Fisher 1956).

Results of statistical test are presented in the following way:

t-tests: t (*degrees of freedom)=t-value*, p=*significance value (0-1);* and

χ^2 tests: χ^2*(degrees of freedom)*= χ^2*(observed value),* p=*significance value (0-1).*

All χ^2 test are run on the number of observations (n), even if some of the presented figures accompanying the tests are presenting the data in %, predominantly to account for different sample sizes among the groups and proportions.

All tests are run on $\propto$=0.05, significant differences are indicated as: * 10% level, ** 5% level, *** 1% level.

Table 9: Frequencies and sampling weights for group comparisons

Group	Strata	Absolute frequency in population (N)	Relative frequency in population (%)	Absolute frequency in sample (n)	Relative frequency in sample (%)	Sampling weight for extrapolation
I.	Female-headed HHs	256	18.96	256	19.36	0.979
	Male-headed HHs	1066	78.96	1066	80.64	0.979
	Unclear (double entries)	28	2.07	0	0.00	0.000
	All	1350	100.00	1322	100.00	
II.	Multidimensionally poor HHs	448	33.19	448	33.19	1.000
	Non-multidimensionally poor HHs	902	66.81	902	66.81	1.000
	All	1350	100.00	1350	100.00	
III.	Non-contracted HHs	1147	84.96	1147	76.11	1.773
	Contracted HHs	203	15.04	360	23.89	0.629
	All	1350	100.00	1507	100.00	
IV.	Vanilla farmers	1115	82.59	1115	100.00	0.826
	No vanilla farmers	235	17.41	0	0.00	0.000
	All	1350	100.00	1115	100.00	

4. RESULTS OF GROUP COMPARISONS

4.1. Household size

The analysed variable is based on the question: how many persons live in the respective HH.

Table 10: Household size; male- vs. female-headed HHs

Household head	Number of persons		
	N	Mean	Std. Error Mean
Male	1066	4.97***	0.06
Female	256	4.09	0.14

Male-headed HHs have significantly larger HH sizes (4.97 on average) than female-headed HHs (4.09; t-tests, $t(1320)= 5.69$, $p= <0.001$).

Table 11: Household size; MD poor vs. MD non-poor HHs

MD poor	Number of persons		
	N	Mean	Std. Error Mean
Yes	448	4.51***	0.10
No	902	4.94	0.07

MD poor HHs have significantly smaller HH sizes (4.51 on average) than MD non-poor HHs (4.94; t-test, $t(1348):3.362$, $p=0.001$).

Table 12: Household size; contracted vs. non-contracted HHs

Contracted	Number of persons		
	N	Mean	Std. Error Mean
Yes	360	5.21***	0.10
No	1147	4.72	0.06

Contracted HHs have significantly larger HH sizes (5.21 on average) than non-contracted HHs (4.72; t-test, $t(1505) = 3.62$, $p=<0.001$).

4.2 Education

4.2.1. Years of schooling by household head

The analysed variable is based on the question how many years of schooling did the HH head receive.

Table 13: Years of schooling household head; male- vs. female-headed HHs

Household head	Years of schooling		
	N	Mean	Std. Error Mean
Male	1065	5.60**	0.20
Female	256	4.48	0.45

Female HH heads received significantly less years of schooling (4.5 years on average) than male HH heads (5.6 years; t-test, t(1321=2.406, p= 0.016).

Table 14: Years of schooling household head; MD poor vs. MD non-poor HHs

MD poor	Years of schooling		
	N	Mean	Std. Error Mean
Yes	443	5.10	0.37
No	885	5.52	0.20

The variances of the two groups are not equally distributed (Levene test, p=0.001). Therefore, we conducted Mann Whitney tests, which revealed no significant differences between MD poor and MD non-poor HHs (p=0.48).

Table 15: Years of schooling household head; contracted vs. non-contracted HHs

Contracted	Years of schooling		
	N	Mean	Std. Error Mean
Yes	354	5.68	0.46
No	1128	5.35	0.19

HH heads of contracted HHs received 5.7 years of schooling, on average, compared to 5.4 years of non-contracted HH heads. However, there are no significant differences in the years of schooling between the groups (t-test, t(1480) = 0.760, p=0.45).

4.2.2. School certificates by household heads

In addition to the years of schooling that HH heads received, we also looked for differences in school certificates that HH heads obtained. School certificates are classified according to UNESCO (2017).

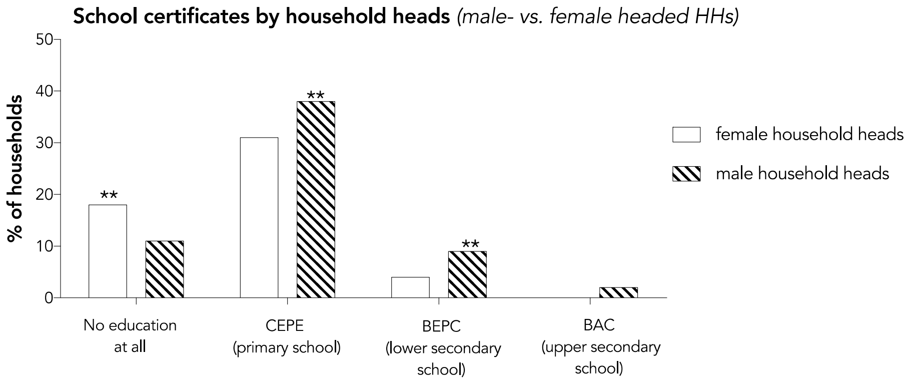

Figure 23: School certificates of the household head; male vs. female HH heads, n=1327

Female HH heads are significantly more likely to have no education at all (18.3 %) than male HH heads (11.3%; $\chi^2(1)=5.216$, $p=0.022$). Consequently, a significantly larger amount of male HH heads obtained primary school degrees (38.1%) compared to female HH heads (30.5%; $X^2(1)=3.472$, $p=0.022$). Likewise, a larger amount of male HH heads finished lower secondary (9.0%) compared to female HH heads (3.8%; $\chi^2(1)=7.022$, $p=0.008$). Just 0.4 % of female HH heads finished upper secondary, compared to 1.6% of male HH heads. However, there are no significant differences ($\chi^2(1)=1.602$, $p=0.206$).

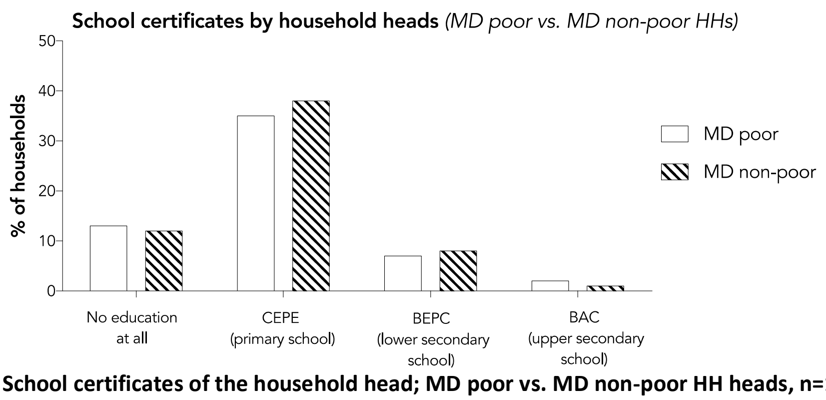

Figure 24: School certificates of the household head; MD poor vs. MD non-poor HH heads, n=1328

While there are no significant differences between the two groups, 13.1 % of MD poor HH heads stated that they have no education at all compared to 12.4% of MD non-poor HH heads ($\chi^2(1)=1.151$, $p=0.283$). Consequently, 34.6% of MD poor HH heads finished primary school compared to 37.6% of MD non-poor HH heads, without significant differences between the two groups ($\chi^2(1)$=1.120, p=0.290). An average of 7% of MD poor HH heads finished lower secondary compared to 8.5% of MD non-poor HHs, with no significant differences between the two groups ($\chi^2(1)$=0.660, p=0.417). Additionally, 1.8 % of MD poor HH heads finished upper secondary school compared to MD non-poor HH heads (1.1%). Yet, there are no significant differences between the groups ($\chi^2(1)$=0.578, p=0.447).

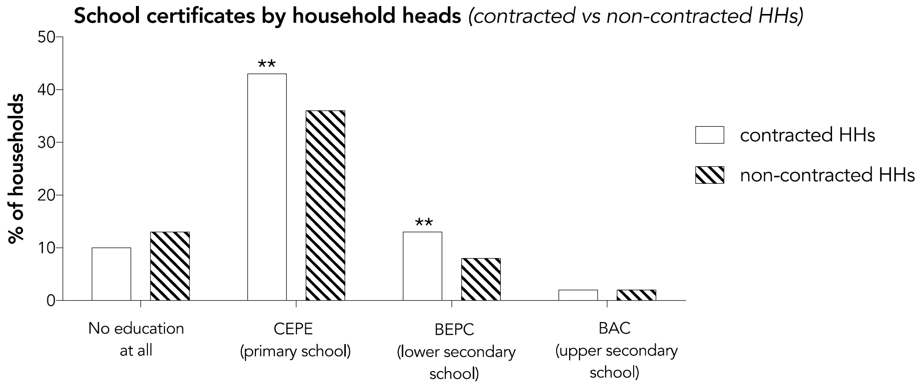

Figure 25: School certificates of the household head; contracted vs. non-contracted HH heads, n=1485

Of the HHs surveyed, 12.9 % of non-contracted HH heads reported to have no education at all compared to 10.4% of contracted HH heads. There are no significant differences between both groups ($\chi^2(1)$= 1.564; p=0.211). Still, contracted HH heads have significantly more often a primary school degree (42.9%) than non-contracted HH heads (35.5%; $\chi^2(1)$=6.19; p=0.013). Similarly, contracted HH heads have significantly more often a degree of lower secondary school (12.6 %) then non-contracted HH heads (7.7 %; $\chi^2(1)$= 8.014 ; p=0.005).

2.2% of contracted HHs finished upper secondary compared to 1.5 % of non-contracted HHs, without significant differences between the groups ($\chi^2(1)$=0.882; p=0.348).

4.3 Household assets

The analysed variable is based on the question: which of the following items does the HH possess (radio, mobile phone, TV, solar panels, generator, motorbike, car and jeep). There were 8 items in total (see question 35 in questionnaire). The variable analysed is the sum of all listed assets (a number between Min=0 and Max=8).

Table 16: Household assets; male vs. female-headed HHs

Household head	Sum of Assets		
	N	Mean	Std. Error Mean
Male	1066	2.28***	0.04
Female	256	1.49	0.07

Male-headed HHs possess significantly more (2.3 on average) of the summed assets than female-headed HHs (1.5 on average; t-test, $t(1320) = 8.54$, $p=<0.001$).

Table 17: Household assets; MD poor vs. MD non-poor HHs

MD poor	Sum of Assets		
	N	Mean	Std. Error Mean
Yes	448	1.97**	0.06
No	902	2.19	0.04

MD poor HHs possess significantly fewer of the listed assets (1.97 on average) than MD non-poor HHs (2.19 on average; t-test, $t(1348)= 2.82$, $p=0.005$).

Table 18: Household assets; contracted vs. non-contracted HHs

Contracted	Sum of Assets		
	N	Mean	Std. Error Mean
Yes	360	2.62***	0.07
No	1147	2.05	0.04

Since the variances of the dataset are not homogenously distributed (Levene test, $p=0.001$), we conducted a non-parametric Mann Whitney test. The test revealed that contracted HHs possess significantly more assets (2.62 on average) than non-contracted HHs (2.05; $p=<0.001$).

4.4 Vanilla farming

In this introductory section on vanilla farming, we present the percentages of the different pairs of groups, who cultivate vanilla.

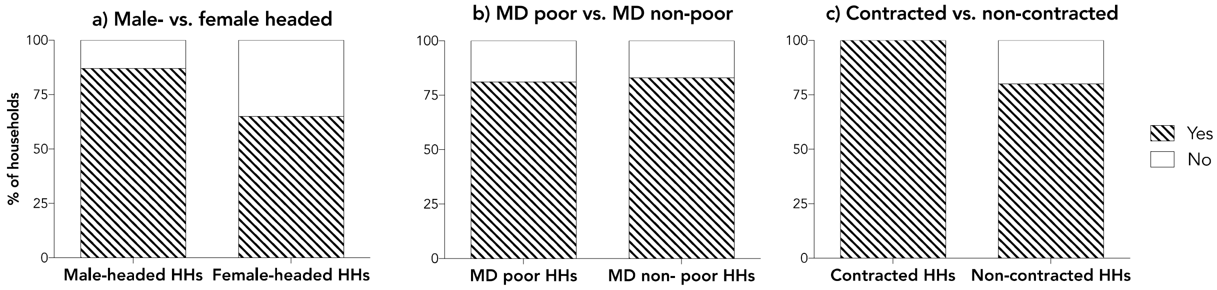

Figure 26: Does the household farm vanilla? a) male- vs. female headed HHs, b) MD poor vs. MD non-poor HHs, c) contracted vs. non-contracted HHs

As we see in Fig. 26a, female-headed HHs (65%) cultivate vanilla significantly less commonly than male-headed HHs (87%; $\chi^2(1)=68.104$, p=<0.001). Additionally, 81% of MD poor HHs cultivate vanilla compared to 83% of MD non-poor HHs, without significant differences between the groups (Fig. 26b; $\chi^2(1)=0.711$, p=<0.399). As contracted HHs are by definition vanilla famers, they were not compared to non-contracted HHs (Fig. 26c).

In the following sections on vanilla farming and marketing, only HHs that do cultivate vanilla are included. Therefore, the number of observations is reduced for most groups.

4.4.1 Number of vanilla plots per household

Table 19: Number of vanilla plots per HH; male vs. female-headed HHs

Household head	Number of vanilla plots		
	N	Mean	Std. Error Mean
Male	927	1.49***	0.02
Female	170	1.21	0.03

The Levene test showed that the variances are not homogeneously spread (p=<0.001). Therefore, a Mann Whitney test was conducted, which indicates that female-headed HHs possess significantly fewer fields (1.2 on average) than male-headed HHs (1.49 on average, p=<0.001).

Table 20: Number of vanilla plots per HH; MD poor vs. MD non-poor HHs

MD poor	Number of vanilla plots		
	N	Mean	Std. Error Mean
Yes	365	1.44	0.03
No	750	1.45	0.02

MD poor HHs possess, on average, 1.44 vanilla plots compared to 1.45 vanilla plots of MD non-poor HHs. There are no significant differences between the groups (t-test, t(1113)=-0.190, p=0.849)

Table 21: Number of vanilla plots per HH; contracted vs. non-contracted HHs

Contracted	Number of vanilla plots		
	N	Mean	Std. Error Mean
Yes	360	1.65^{***}	0.04
No	912	1.41	0.02

Contracted HHs possess significantly more vanilla plots (1.65 on average) than non-contracted HHs (1.41, on average; t-test, t(1270)=5.759, p=<0.001).

4.4.2 Field size, in hectares (ha), as the sum of all vanilla plots

Respondents, who stated that they do farm vanilla, were asked how many fields they have and what the size of the individual vanilla plot is. In the analysis below, field sizes of all vanilla plots are summed.

Table 22: Field size (ha) vanilla plots; male- vs. female-headed HHs

Household head	Field size in ha (sum all plots)		
	N	Mean	Std. Error Mean
Male	926	1.72^{***}	0.06
Female	169	1.16	0.08

The Levene test showed that the variances are not homogenously distributed (p=0.001). Consequently, Mann Whitney test were run, which showed that female-headed HHs have significantly smaller total field sizes (1.16 ha on average) than male-headed HHs (1.72 ha; p=<0.001).

Table 23: Field size (ha) vanilla plots; MD poor vs. MD non-poor HHs

MD poor	Field size in ha (sum all plots)		
	N	Mean	Std. Error Mean
Yes	364	1.59	0.11
No	749	1.64	0.06

Summed vanilla plots of MD poor HHs have an average size of 1.59 ha compared to 1.64 ha of MD non-poor HHs. There are no significant differences between the groups (t(1111)=-0.408, P=0.683).

Table 24: Field size (ha) vanilla plots; contracted vs. non-contracted HHs

Contracted	Field size in ha (sum all plots)		
	N	Mean	Std. Error Mean
Yes	360	1.95^{***}	0.11
No	910	1.55	0.05

Contracted HHs have significantly larger vanilla field sizes (1.95 ha on average) than non-contracted HHs (1.55 ha; t(1268)=3.359, p=0.001)

4.4.3 Age of the oldest vanilla field

Vanilla farming HHs were asked how long they have been farming on their vanilla fields (in years). The age of the oldest field that the HHs possess are computed as a proxy of experience in vanilla farming in the village where the HHs are living today.

Table 25: Experience in vanilla farming in years; male vs. female-headed HHs

Household head	Age (years) of oldest vanilla field		
	N	Mean	Std. Error Mean
Male	926	12.26	0.43
Female	169	13.89	0.98

The oldest vanilla field that male-headed HHs possess is, on average, 12.3 years old, compared to 13.9 years for female-headed HHs' fields. There are no significant differences in the age of the vanilla fields between male- and female-headed HHs (t-test, t(1093)= -1.49, p=0.137).

Table 26: Experience in vanilla farming in years; MD poor vs. MD non-poor HHs

MD poor	Age (years) of oldest vanilla field		
	N	Mean	Std. Error Mean
Yes	364	12.53	0.72
No	749	12.56	0.46

The oldest vanilla field of MD-poor HHs is, on average, 12.5 years old, compared to 12.6 years for MD non-poor HHs. There are no significant differences between MD poor and MD non-poor HHs (t-test, t (1111) = - 0.31, p = 0.975).

Table 27: Experience in vanilla farming in years; contracted vs. non-contracted HHs

Contracted	Age (years) of oldest vanilla field		
	N	Mean	Std. Error Mean
Yes	360	15.27^{***}	0.71
No	910	12.10	0.42

On average, contracted HHs have significantly older vanilla fields (15.3 years) than non-contracted HHs (12.1 years; t-test, t (1268)= 3.913, p=<0.001).

4.5. Sale of green vanilla

4.5.1 Does the household sell green vanilla?

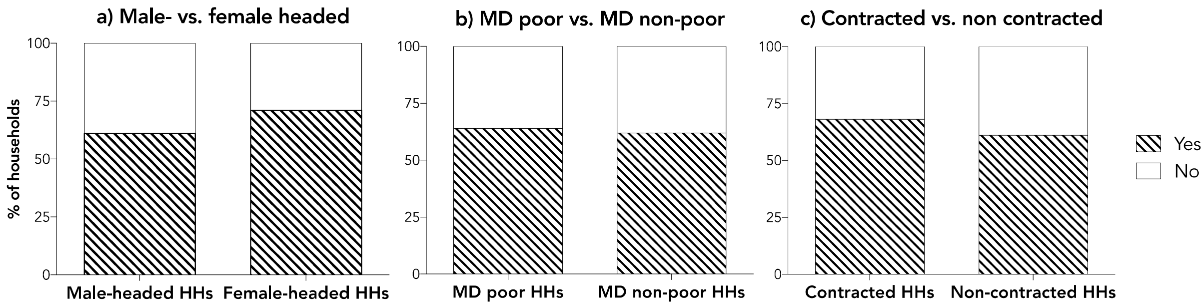

Figure 27: Does the household sell green vanilla? a) male- vs. female headed HHs; b) MD poor vs. MD non-poor HHs; c) contracted vs. non-contracted HHs

As we see in Figure 27a, female-headed HHs sell green vanilla significantly more frequently (71%) than male-headed HHs (61%; $\chi^2(1)=5.877$, p=0.053. Just under two thirds (64%) of MD poor HHs sell green vanilla compared to MD non-poor HHs (62%, Figure 27b). However, there are no significant differences between the groups ($\chi^2(1)=2.999$, p=0.083). Sixty-eight % of contracted HHs sell green vanilla compared to non-contracted HHs (61%, Figure 27c). There are no significant differences between the groups (χ^2((1)=4.899, p=0.484).

In the following section, only HHs that sell green vanilla are included. Therefore, the number of observations per group is reduced.

4.5.2. Quantity of vanilla sold green in 2016

Respondents were asked how many kg of green vanilla they sold in 2016.

We conducted a one-sided Grub´s outlier test (maximum values, see Appendix 4). Based on the test, 28 outliers were removed (p=<0.005).

Table 28: Quantity of vanilla sold green (in kg); male vs. female-headed HHs

Household head	Harvest green vanilla (in kg) in 2016		
	N	Mean	Std. Error Mean
Male	904	50.55***	2.09
Female	168	31.11	3.49

The Shapiro Wilk test shows that the dataset is non-normally distributed (p=<0.001). Therefore, we run a Mann Whitney test instead of a t-test. Male-headed HHs sold significantly more quantities of green vanilla (50.6 kg on average) than female-headed HHs (31.1 kg on average, p =<0.001).

Table 29: Quantity of vanilla sold green (in kg); MD poor vs. MD non-poor HHs

MD poor	Harvest green vanilla (in kg) in 2016		
	N	Mean	Std. Error Mean
Yes	357	47.24	3.12
No	732	47.40	2.28

As the data is non-normally distributed (Shapiro-Wilk test, p=<0.001), we conducted a Mann Whitney test. However, this did not highlight any significant differences between the groups (p=0.682).

Table 30: Quantity of vanilla sold green (in kg); contracted vs. non-contracted HHs

Contracted	Harvest green vanilla (in kg) in 2016		
	N	Mean	Std. Error Mean
Yes	349	75.83***	4.04
No	893	41.98	1.88

The dataset on vanilla prices received is non-normally distributed (Shapiro-Wilk test, p=<0.001). Therefore, a Mann Whitney test was conducted, which showed that contracted HHs sold significantly more green vanilla then non-contracted HHs (Mann Whitney-test, p= <0.001).

4.5.3 Price received per kg of green vanilla and the month in 2016 in which it was sold

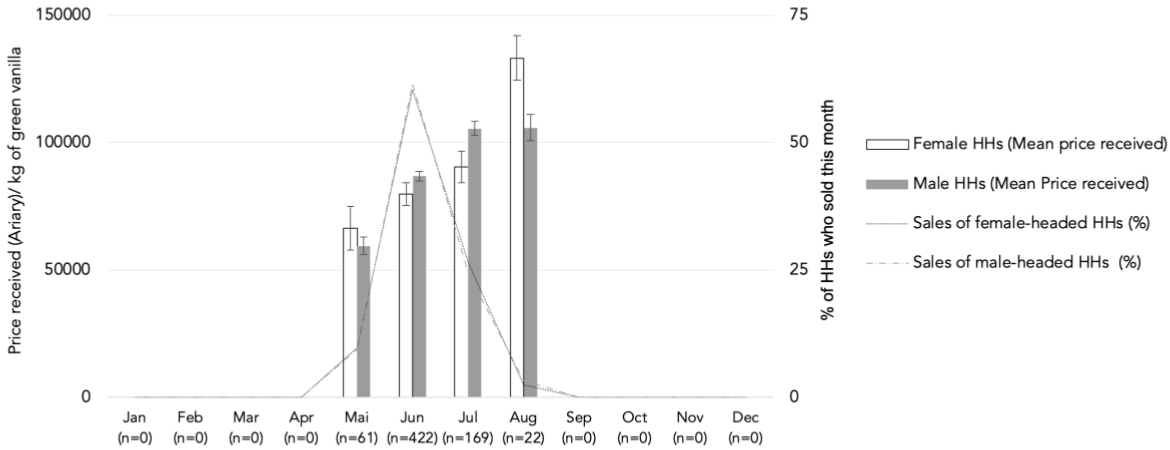

Figure 28: Price received for green vanilla by month (left axis) and % of HHs that sold in this month (right axis): male- vs. female-headed HHs (n=674). Mean +/- St. Error

As shown in Figure 28, prices for green vanilla steadily increased between May and August in 2016. Observing the prices received, male-headed HHs received significantly higher prices in July than female-headed HHs (t(167)=2.380, p=0.018). The mean difference is 15,098 ± 6,345 Ariary. Around 26.4% (female-headed HHs) and 24.3% (male-headed HHs) sold in July.

In August female-headed HHs received significantly higher prices (t(20)= -2.016, p=0.057). The mean difference is 27,386 ± 13,585 Ariary. However, only ~3 % of female-headed HHs sold in August. The majority (61.6%) of male-headed HHs sold vanilla in June as well as 60.3% of female-headed HHs, respectively. Between 9.5% and 9.9% of all HHs sold in May. There are no significant differences in the months in which green vanilla was sold. In fact, the two lines for male-and female-headed HHs are almost identical (Fig.28).

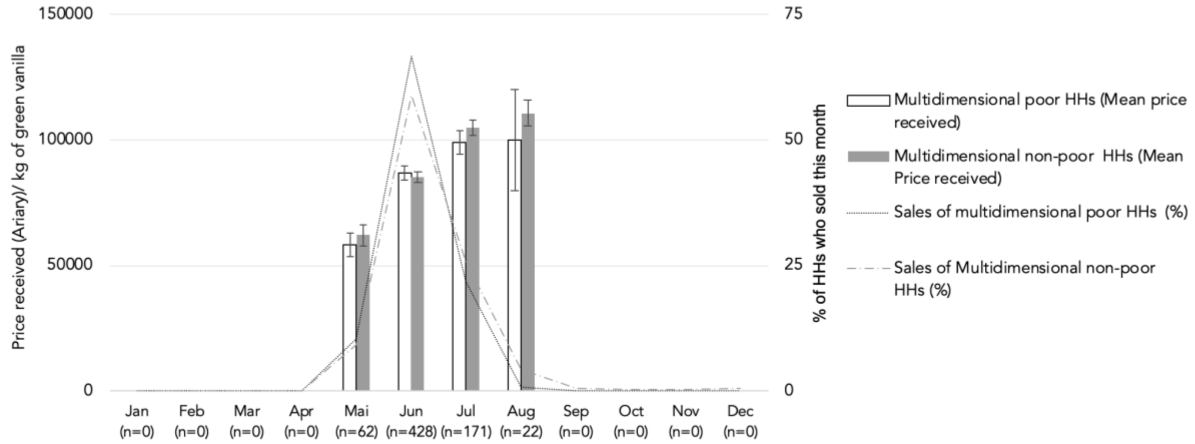

Figure 29: Price received for green vanilla by month (left axis) and % of HHs that sold in this month (right axis) ; MD poor vs. MD non-poor HHs (n=683). Mean +/- St. Error

There were no significant differences in the months vanilla was sold (χ^2 tests) nor in prices received in all months between MD poor- and non-poor HHs (t-tests). As we see in Figure 29, prices increased progressively between May and August. The majority (67%) of MD poor HHs and 59 % of MD non-poor HHs sold in June. On average, ~ 24% sold in July, and 9.5% in May.

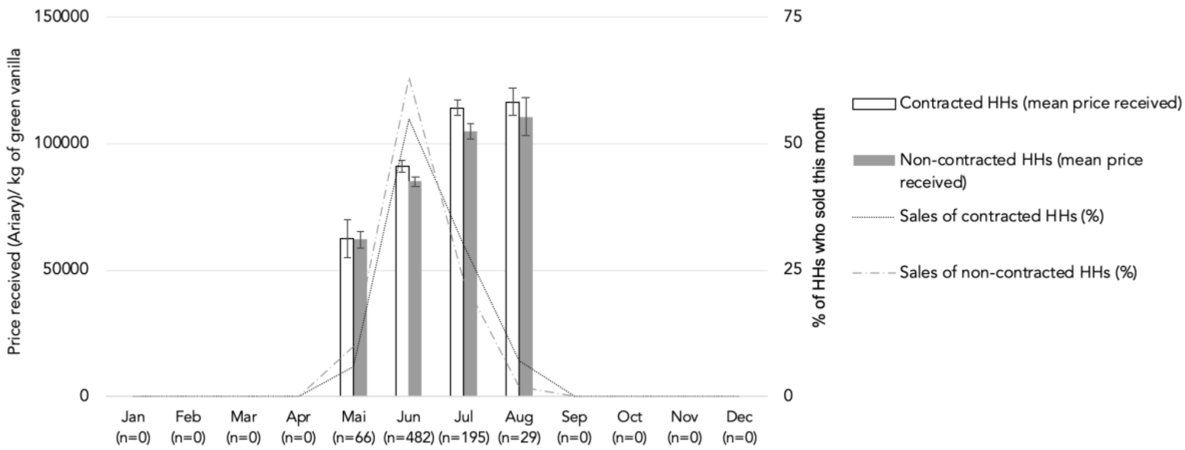

Figure 30: Price received for green vanilla by month (left axis) and % of HHs that sold in this month (right axis): contracted vs. non-contracted HHs (n=772). Mean +/- St. Error

Contracted HHs received significantly higher prices in June and July than non-contracted HHs (t-tests, June=t(1.89), p=0.05; July= t(193), p=<0.001). The mean difference in June and July were 6,484 $\pm$ 3,425 Ariary and 15,646 $\pm$ 4,723 Ariary, respectively. June (55% of HHs) and July (30% of HHs) were also the months were most contracted HHs sold their vanilla. Only 6% of contracted HHs sold their vanilla in May compared to 10% of non-contracted HHs.

4.6 Sale of black vanilla

4.6.1 Does the household sell black vanilla?

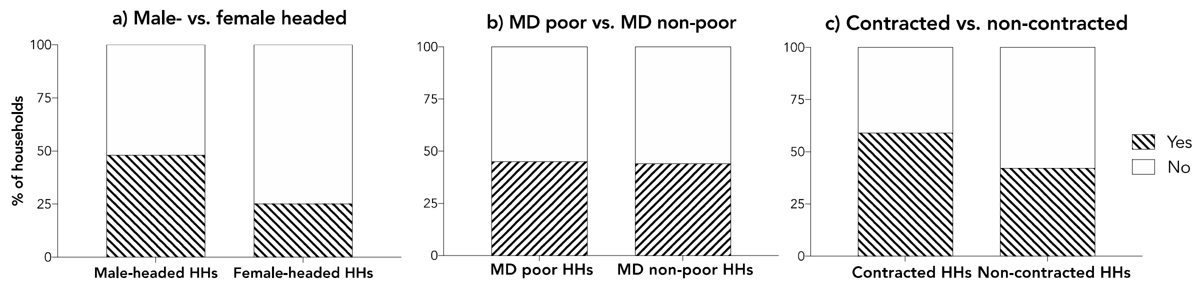

Figure 31: Does the household sell black vanilla? a) male- vs. female headed HHs; b) MD poor vs. MD non-poor HHs; c) contracted vs. non-contracted HHs

A significantly smaller share of female-headed HHs (25%) report that they sell black vanilla, compared to 48% of male-headed HHs ($\chi^2(1)$ =31.433, p=<0.001, Fig. 31a). Additionally, 45% of MD poor HHs report that they sell black vanilla compared to 44% of MD non-poor HHs (Fig. 31b). There are no significant differences between both groups ($\chi^2(1)$=0.092, p=0.761). A significantly higher amount of contracted HHs (59%) report that they sell black vanilla compared to non-contracted HHs (42%; $\chi^2(1)$ = 28.918, p=<0.001, see Fig. 31c).
In the following section, only HHs that do sell black vanilla are included.

4.6.2 Quantity of vanilla sold black in 2016

Respondents were asked how many kg of black vanilla they sold in 2016/17. We conducted a one-sided Grub´s outlier test (maximum values, see Appendix 4). Based on the tests, 15 outliers were removed (p=<0.005).

Table 31: Quantity of vanilla sold black (in kg); male vs. female-headed HHs

Household head	Quantity of black vanilla (in kg) sold in 2016		
	N	Mean	Std. Error Mean
Male	433	27.25***	3.43
Female	80	5.90	1.71

As the Shapiro-Wilk test indicated that the dataset is non-normally distributed (p=0.001), we conducted a Mann Whitney test. The test confirms that female-headed HHs sold significantly less black vanilla (5.9 kg on average) than male-headed HHs (27.3 kg on average; p= <0.001).

Table 32: Quantity of vanilla sold black (in kg); MD poor vs. MD non-poor HHs

MD poor	Quantity of black vanilla (in kg) sold in 2016		
	N	Mean	Std. Error Mean
Yes	172	29.95	6.51
No	353	20.80	2.85

MD poor HHs sold, on average, 30.0 kg of black vanilla compared to 20.8 kg of MD non-poor HHs. However, there are no statistically significant differences (t-test, t(523)=1.496, p=0.135).

Table 33: Quantity of vanilla sold black (in kg); contracted vs. non-contracted HHs

Contracted	Quantity of black vanilla (in kg) sold in 2016		
	N	Mean	Std. Error Mean
Yes	183	43.66***	7.00
No	530	18.97	2.37

The variances of the dataset are non-normally distributed (Levene test, p=<0.001). Therefore, a Mann Whitney test was conducted, which indicates that contracted HHs sold significantly more black vanilla (43.7 kg on average) than non-contracted HHs (19.0 kg on average; p=<0.001)

4.6.3 Reasons to sell black vanilla

For the following question, only answers from respondents who sell black vanilla are included. Multiple answers were possible.

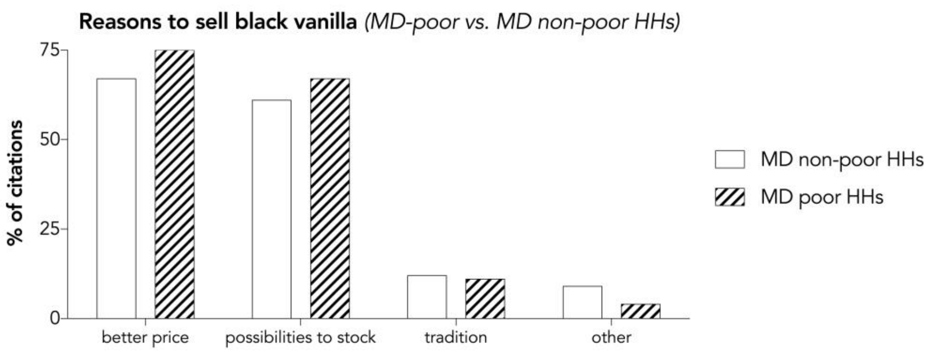

Figure 32: Reasons to sell black vanilla; male (n=442) vs. female-headed HHs (n=42)

Among the reasons to sell black vanilla, *"better price"* is cited by 64.3% and 69.9% of male-headed and female-headed HHs, respectively. We also conducted a χ^2 test, that revealed significant differences between the answers of male- and female-headed HHs (p=0.014).

Therefore, we performed Fisher´s exact test, which highlights that female-headed HHs responded *"possibilities to stock"* significantly more often (76.2%, p=<0.005) as a reason to sell black vanilla, compared to 61.8% of male-headed HHs. Contrariwise, male-headed HHs cited *"tradition"* significantly more frequently, 12.4%, (p=<0.005) as a reason to sell black vanilla, compared to 4.8% by female-headed HHs

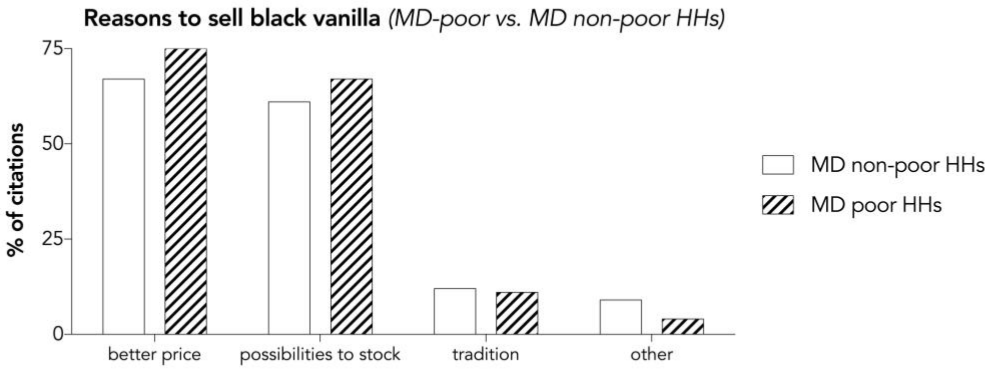

Figure 33: Reasons to sell black vanilla; MD poor (n=162) vs. MD non-poor HHs (n=327)

The χ^2 test does not show any significant differences in the answers given by MD poor and MD non-poor HHs (χ^2 test; p=0.64). The most frequently cited reason is *"better price"*, with 75.3% and 66.7% of MD poor HHs and MD non-poor HHs citing this as a reason, respectively. Likewise, *"possibilities to stock"* is commonly cited, with 66.7% and 60.6% of MD poor HHs and MD non-poor HHs (60.6%) citing this as reason, respectively. "*Tradition"* is cited by ~11% of both groups.

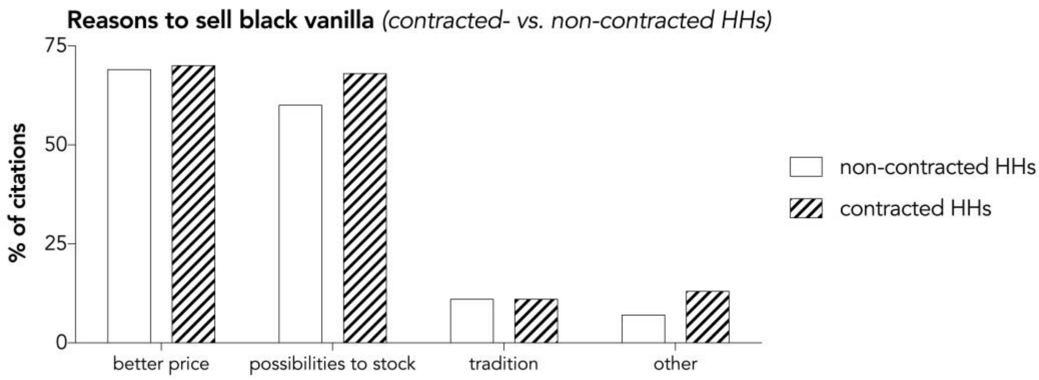

Figure 34: Reasons to sell black vanilla, contracted (n=211) vs. non-contracted HHs (n=384)

The overall X^2 test does not show any significant differences between contracted and non-contracted HHs (X^2 test, p=0.613). *"Better price"* is the most cited reason for selling black vanilla by both groups (~70% on average). *"Possibilities to stock"* is another frequently cited reason for selling black vanilla, and is cited by 67.8% of contracted HHs, and 60.2% of non-contracted HHs. *"Tradition"* is cited by around 11% of all respondents.

4.6.4. Reasons not to sell black vanilla

In this section, only answers from respondents who do not sell black vanilla are included. Multiple answers were possible.

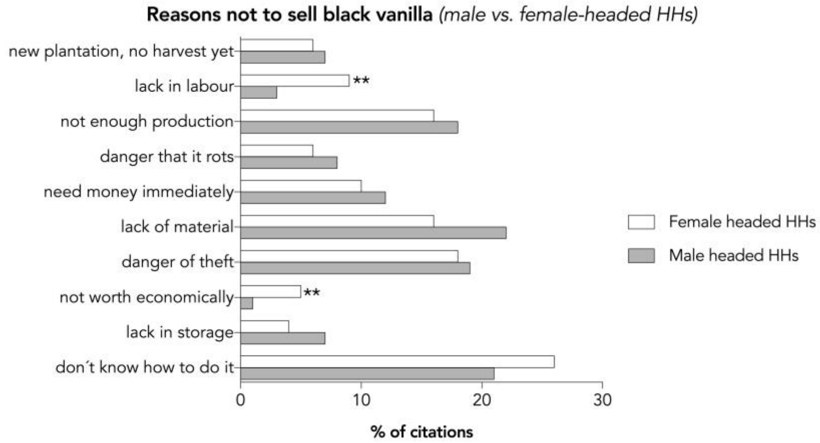

Figure 35: Reasons not to sell black vanilla; male (n=477) vs. female-headed HHs (n=128)

The reasons provided for why HHs do not sell black vanilla are manifold, and there are significant differences between male- and female-headed HHs ($\chi^2(9)=18.03$; $p=0.035$).

The Fisher´s exact test shows that the proportion of female-headed HHs (8.6%) citing a *"lack of labour"* as a reason why they do not sell black vanilla is significantly higher than male-headed HHs (3.3%; p=<0.005). Likewise, a higher proportion, 4.7%, of female-headed HHs state that selling black vanilla is *"not worth [it] economically"* compared to just 1.3% of male-headed HHs (p=<0.005). A higher proportion, 25.8%, of female-headed HHs state that they *"don´t know how to do it"* compared to 20.8% of male-headed HHs. However, there are no significant differences between the groups. Other often cited reasons not to sell black vanilla by both groups include *"danger of theft"* (~18% on average), *"lack of material"* (19 % on average) and *"not enough production"* (~17% on average).

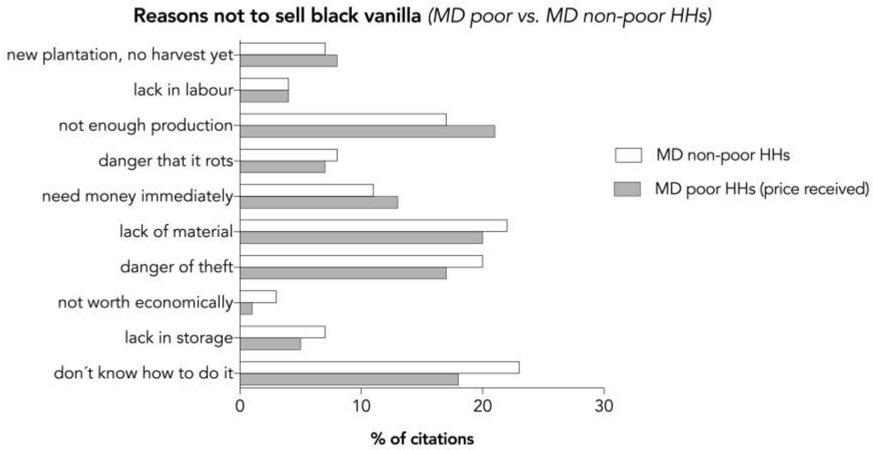

Figure 36: Reasons not sell black vanilla; MD poor (n=201) vs. MD non-poor HHs (n=418)

The overall χ^2 test shows no significant differences between both groups ($\chi^2(9)=16.919$, $p=0.677$). A higher proportion of MD non-poor HHs (23.4%) than MD poor HHs (17.9%) cite that they *"don´t know how to do it"* as a reason for why they are not selling black vanilla compared to 17.9% by MD poor HHs. Just over a fifth (20.9%) of MD poor HHs (20.9%) state that they do not sell black vanilla as they don´t produce enough, compared to 16.5% of MD non-poor HHs.

On average, respondents from both groups frequently cite *"danger of theft"* (18.6%) as well as *"lack of material"* (20.9%) as reasons why they do not sell black vanilla.

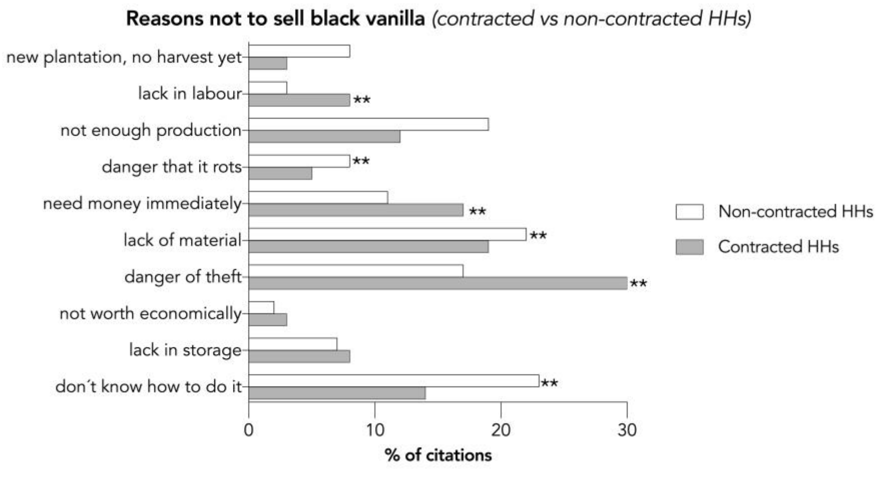

Figure 37: Reasons not sell black vanilla; contracted HHs (n=154) vs. non-contracted HHs (n=522)

The overall χ^2 test displays significant differences between the answers of both groups (x2(9)=16.919, p=<0.001). Specifically, the Fisher´s exact test shows that a significantly higher proportion, 30.3%, of contracted HHs cite *"danger of theft"* as a reason not to sell black vanilla compared to 16.7% of non-contracted HHs (p=<0.05). This trend is also evident when considering the response that there is a *"danger that it rots",* with 8.0% of contracted HHs providing this as a reason compared to 4.9% of non-contracted HHs (p=<0.05).

On the contrary, a significantly higher proportion (22.6%) of non-contracted HHs state that they do not sell black vanilla because they *"don´t know how to do it"* than contracted HHs (14.5%, p=<0.05). Similarly, a significantly higher proportion of non-contracted HHs, 18.8%, state that they do not sell black vanilla as there is *"not enough production"* compared to 12.4% of contracted HHs (p=<0.005). Additionally, a higher proportion, 8.0%, of non-contracted HHs cite *"new plantation, no harvest yet" as a reason why they do not sell black vanilla, compared to* 2.8% of contracted HHs (2.8%, p=<0.05).

Another often mentioned reason cited is a *"lack of material"* (20.1% on average).

4.6.5 Price received per kg of black vanilla and the month in 2016/7 in which it was sold

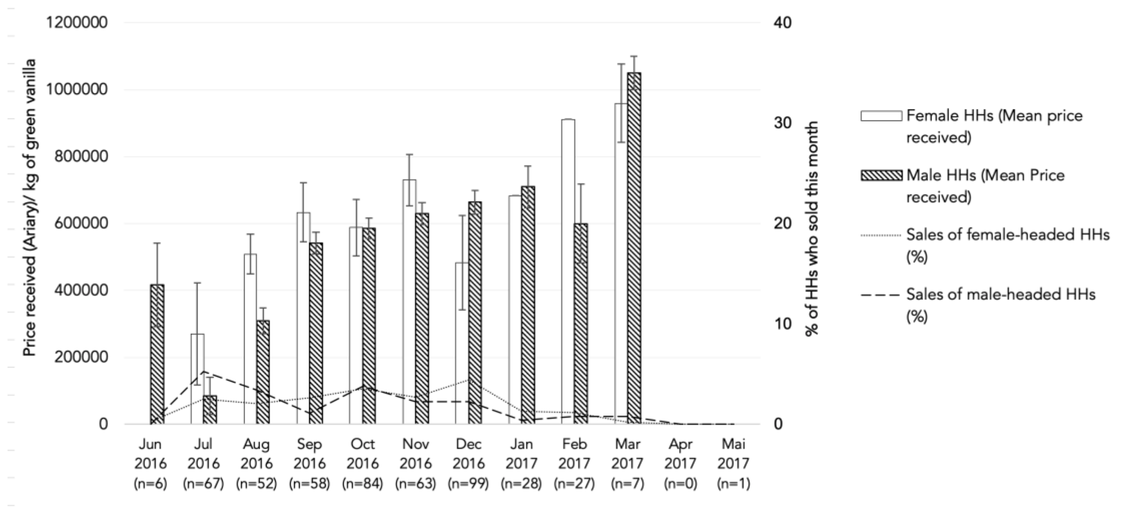

Figure 38: Price received per kg black vanilla depending on month (left axis) and % of HHs who sold this month (right axis). Male vs. female-headed HHs (n=474). Mean +/- St. Error

In July and August male-headed HHs received significantly higher prices than female-headed HHs; July (t(65)=2.043, p=0.045), with a mean difference of 185,486 ± 90,804 Ariary; August (t(49)=2.344, p=0.023), with a mean difference of 198,590 ± 84 736 Ariary, see Figure 38.

A significantly higher proportion (26%) of female-headed HHs sold black vanilla in July than male-headed HHs (13%, $\chi^2(1)=7.424$, p=0.006). On the contrary, a significantly higher proportion (22%) of male-headed HHs sold black vanilla on average in December than female headed HHs (11% on average, $\chi^2(1)=3.304$, p=0.069).

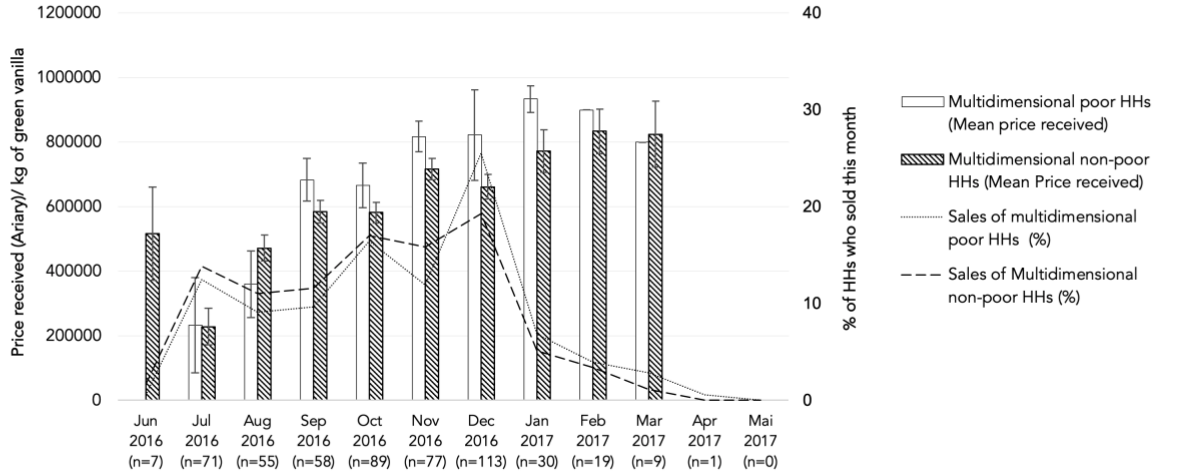

Figure 39: Price received per kg black vanilla depending on month (left axis) and % of HHs who sold this month (right axis); multidimensional poor vs. non-poor HHs (n=529). Mean +/- St. Error

There are no significant differences in prices received between poor- and non-poor HHs in all months (t-tests, p=0.43). Likewise, there are no significant differences in the months where HHs sold vanilla (χ^2 tests p=0.64).

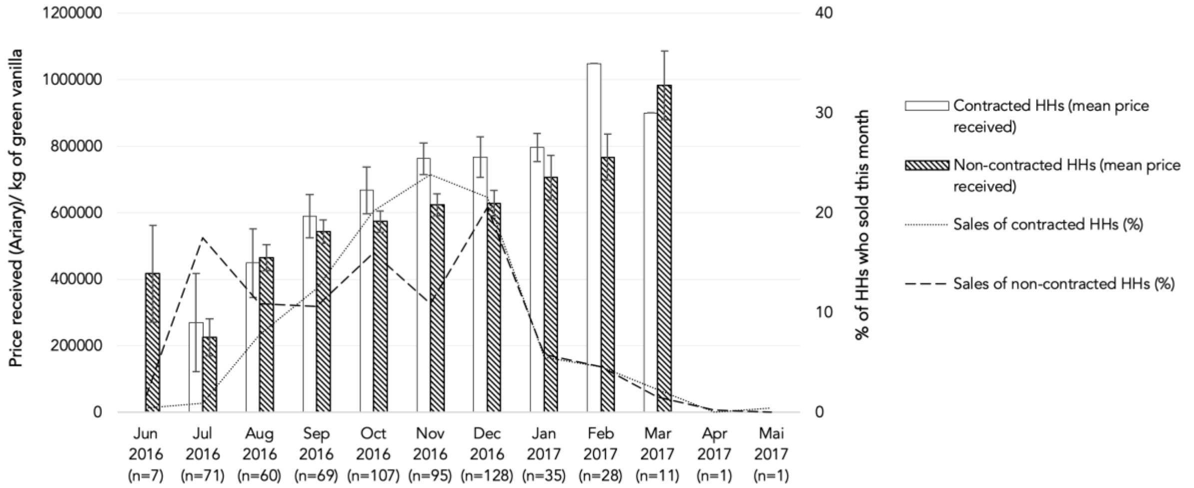

Figure 40: Price received per kg black vanilla depending on month (left axis) and % of HHs who sold this month (right axis); contracted HHs vs. non-contracted HHs (n=613). Mean +/- St. Error

There are significant differences in prices received in October, t(104)=1.864, p=0.065). The mean difference is 93,493 $\pm$ 50,162 Ariary. Contracted HHs also received significantly higher prices in November, t(94)=2.68, p=0.009, and December, (t(126)=2.969, p=0.004 (t-tests)**.** On average, contracted HHs received 122,321 $\pm$45,649 Ariary (November) and 171 819 $\pm$ 57 871 Ariary (December) higher prices then-contracted HHs.

In July, non-contracted HHs sold significantly more often (10.9%) than contracted-HHs (0.9 %,χ^2(1)=37.575, p=<0.001).On the contrary, in November, contracted-HHs sold significantly more often (23.9 %) than non-contracted-HHs (10.9 %, x^2(1)=18.036, p=<0.001).

4.7 To whom was vanilla sold

Respondents were asked: to whom do the HHs sell their vanilla to (see Question 17 in Appendix 5). Multiple answers were possible. However, for the analysis and presentation of the data, we merged different company / association/ exporter names into categories due to confidentiality agreements with companies and respondents. Likewise, as *rabatteurs* and commissionaires are very proximate types of buyers, we merged them in one category (see introduction section on traders and middle-men above).

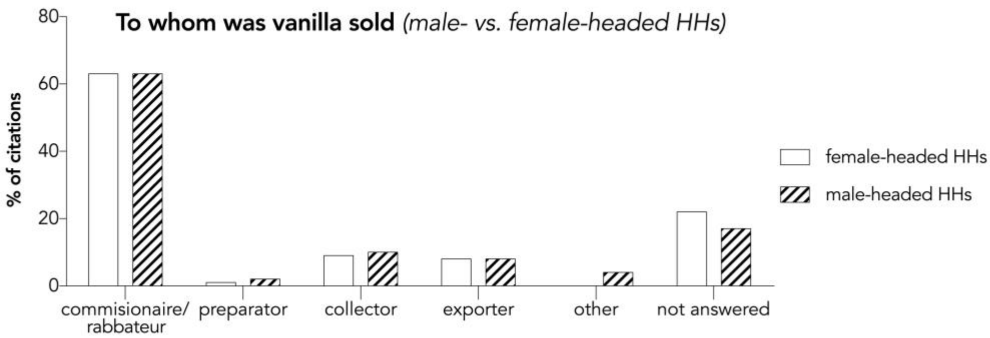

Figure 41: To whom was vanilla sold in 2016; male vs. female-headed HHs

The large majority of both male- and female-headed HHs sell to commissionaires (~63 %). Around 10% of both groups sell to collectors and around 8% directly to exporters. There are no significant differences between male- and female-headed HHs ($\chi^2(11)=11.094$, p= 0.435). On average, 19% of all respondents did not answer.

Figure 42: To whom was vanilla sold in 2016; MD poor vs. MD non-poor HHs

An overall χ^2 test showed significant differences between MD poor and MD non-poor HHs ($\chi^2(11)= 23.673$, p=0.014). The Fisher's exact test revealed that the following differences exist: a significantly higher proportion (63.8%) of MD poor HHs sell vanilla to commissionaires than MD non-poor HHs (51.5%, p=<0.05). Likewise, a significantly higher proportion (9.7%) of MD poor HHs sell vanilla to exporters than MDP non-poor HHs (6.2%, p=<0.05). On average, 16% of respondents did not answer the question.

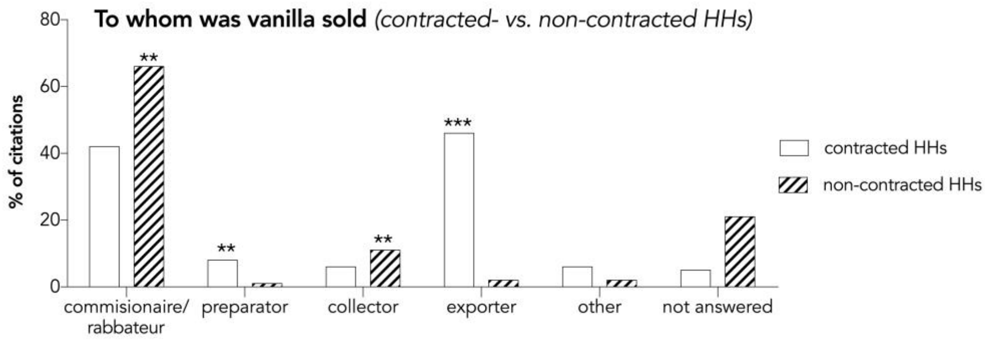

Figure 43: To whom was vanilla sold in 2016; contracted HHs vs. non-contracted HHs

The χ^2 test shows that there are significant differences between the buyers of contracted vs. non-contracted farmers ($\chi^2(11)=595.811$, p=<0.001). Subsequently, Fisher´s exact test uncovered the following differences: a significantly higher proportion (66.4%) of non-contracted HHs sell to commissionaires than contracted HHs (41.9%, p=<0.005). Likewise, a significantly higher proportion (10.8 %) of non-contracted HHs sell to collectors compared to non-contracted HHs (5.6 %, p=<0.005).

Contrarily, a significantly higher proportion (46.4 % and 7.9%) of contracted HHs sell to exporters and preparators, respectively, than non-contracted HHs (1.8 %, p=<0.001 and 0.6 %, p=<0.005).

4.8 Trust towards vanilla buyers

4.8.1 Trust towards vanilla collectors

Respondents were asked to rate the statement *"I do trust vanilla collectors"* on a Likert scale between 1 = strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree, 5 = strongly agree. Only vanilla farming HHs are included.

Table 34: Trust towards vanilla collectors; male- vs. female-headed HHs

Household head	I do trust the vanilla collectors		
	N	Mean	Std. Error Mean
Male	1063	3.16	0.03
Female	189	3.10	0.07

On average, male-headed HHs agreed more with the statement than female-headed HHs. However, the difference is not statistically significant (t(1250)=0.875, p=0.46).

Table 35: Trust towards vanilla collectors; MD poor vs. MD non-poor HHs

MD poor	I do trust the vanilla collectors		
	N	Mean	Std. Error Mean
Yes	417	3.21	0.05
No	855	3.12	0.03

MD poor agreed, on average, more with the statement than MD non-poor HHs. However, the difference is not statistically significant (t(1270)=1.431, p=0.153).

Table 36: Trust towards vanilla collectors, contracted vs. non-contracted HHs

Contracted	I do trust the vanilla collectors		
	N	Mean	Std. Error Mean
Yes	360	3.24**	0.05
No	1147	3.11	0.03

On average, contracted HHs agreed significantly more with the statement than non-contracted HHs (t(1270)=2.037, p=0.042). However, the mean difference is marginal, and, on average, both groups gave scores of close to 3.

4.8.2. Trust towards international companies/ exporters

Respondents were also asked to rate the statement *"I do trust the people from big companies that buy my vanilla"* on a Likert scale between 1 = strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree, 5 = strongly agree. Only vanilla farming HHs are included.

Table 37: Trust towards big vanilla companies; male- vs. female-headed HHs

Household head	I do trust big enterprises that buy my vanilla		
	N	Mean	Std. Error Mean
Male	1066	3.31*	0.04
Female	256	3.14	0.09

On average, male-headed HHs gave a significantly higher score (3.31(to the statement than female-headed HHs (3.14; t(1250)=1.668, p=0.096).

Table 38: Trust towards big vanilla companies; MD poor vs. MD non-poor HHs

MD poor	I do trust big enterprises that buy my vanilla		
	N	Mean	Std. Error Mean
Yes	500	3.31	0.06
No	1007	3.27	0.04

MD non-poor HHs gave, on average, a higher score to the statement than MD poor. However, the difference is not statistically significant (t(1270)= 0.482, p=0.630).

Table 39: Trust towards big vanilla companies, contracted vs. non-contracted HHs

Contracted	I do trust big enterprises that buy my vanilla		
	N	Mean	Std. Error Mean
Yes	360	3.57***	0.06
No	1147	3.17	0.04

Contracted HHs gave, on average, a significantly higher score (3.57) to the statement than non-contracted HHs (3.17; t(1270)=4.889, p=<0.001).

4.8.3. Fear of crime

As theft was identified as a serious socio-economic problem among vanilla farmers (see Section 1.2), farmers were asked to rate the statement ***"I think my plot is constantly threatened by theft"*** on a Likert scale between 1 = strongly disagree, 2 = disagree, 3 = neither agree or disagree, 4 = agree, 5 = strongly agree. Below, we present a short analysis on farmer perceptions regarding the security of their plots across the selected groups.

Table 40: Fear of crime; male- vs. female-headed HHs

Household head	I think my plot is constantly threatened by theft		
	N	Mean	Std. Error Mean
Male	1066	4.11	0.03
Female	256	4.16	0.07

Both male- and female-headed HHs agreed with the statement "*I think my plot is constantly threatened by theft*", without significant differences between the two groups (t(1250)=-0.628, p=0.53).

Table 41: Fear of crime; MD poor vs. MD non-poor HHs

MD poor	I think my plot is constantly threatened by theft		
	N	Mean	Std. Error Mean
Yes	417	4.15	0.04
No	855	4.10	0.03

On average, MD poor and MD non-poor HHs agree with the statement and reported a rate close to 4 "*agree*". However, there are no significant differences among them (t(1270)=-0.78, p=0.43).

Table 42: Fear of crime, contracted vs. non-contracted HHs

Contracted	I think my plot is constantly threatened by theft		
	N	Mean	Std. Error Mean
Yes	360	4.20*	0.04
No	912	4.09	0.03

Both contracted and non-contracted HHs '*agree'* with the statement. However, contracted HHs gave, on average, a significantly higher score to the statement (4.20) than non-contracted HHs (4.09; t(1270)=1.803, p=0.072). The mean difference, however, is marginal.

4.9 Vanilla theft

4.9.1 Was vanilla stolen from the field?

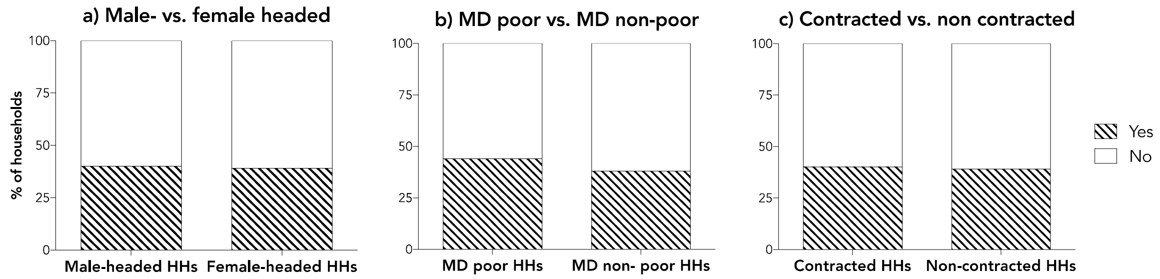

Figure 44: Share of HHs experiencing vanilla theft from the field a) male- vs. female-headed HHs; b) MD poor vs. MD non-poor HHs; c) contracted vs. non-contracted HHs

Between 38% and 44% of all respondents stated that vanilla was stolen from them in 2016. However, there are no significant differences between the groups (χ^2 (5)=3.955, p=0.556).

4.9.2 How much vanilla was stolen?

Respondents were asked how much green vanilla was stolen in 2016 from their fields. Respondents had the possibility to answer in either percentages (% of their total harvest) or in kilograms (kg). Far more respondents used kg (n = 999) as their chosen unit than % (n = 273). As it is not clear if "total havest" includes or exludes theft of green vanilla from the field, we omit the data presented in %.

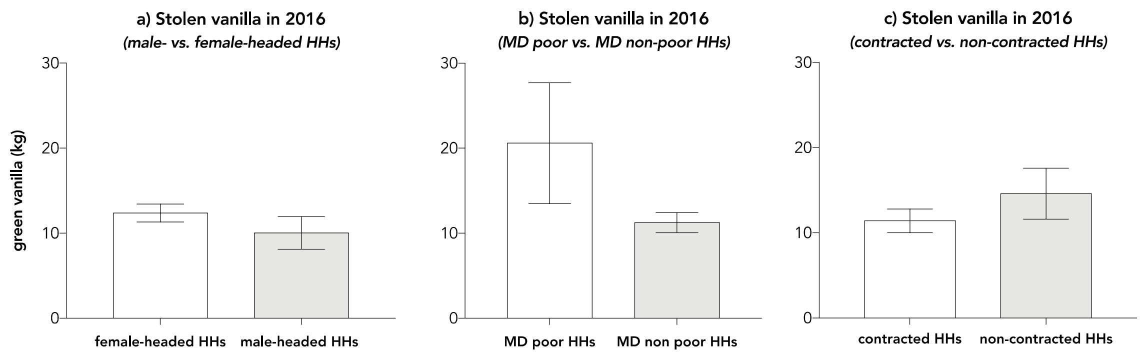

Figure 45: Quantity of vanilla stolen from the field in 2016; a) male (n=729) vs. female-headed HHs (n=129); b) MD poor (n=286) vs. MD non-poor HHs (n=587); c) contracted (n=288) vs. non-contracted HHs (n=711)

On average, female-headed HHs stated that the 12.4kg vanilla was stolen in 2016, compared to the 10.0kg claimed by male-headed HHs. There are no significant differences between both groups (t(856)=0.886, p=0.376). MD poor HHs estimated that 20.61kg were stolen on average compared to 11.25 kg by MD non-poor HHs. The difference is only significant at the 10% level (t(871)=1.786, p=0.074). Non-contracted HHs estimated that there was significantly more vanilla stolen from them (14.61kg) than contracted HHs (11.41 kg, (t (871)=1.786, p=0.074), on average.

4.10 Livelihood diversification

4.10.1. Livestock diversification

The variable analysed is based on how many different livestock classes the HHs possesses, i.e. zebus, sheep, goats, chicken, other poultry and picks.

Table 43: Number of livestock classes; male vs. female-headed HHs

Household head	Number of livestock classes		
	N	Mean	Std. Error Mean
Male	1066	1.56***	0.02
Female	256	1.20	0.05

Female-headed HHs own significantly fewer livestock classes (1.20 on average) than male-headed HHs (1.56, on average; $t(1320)=5.505$, $p=<0.001$)

Table 44: Number of livestock classes; MD poor vs.MD non-poor HHs

MD poor	Number of livestock classes		
	N	Mean	Std. Error Mean
Yes	448	1.44	0.04
No	902	1.52	0.03

On average, MD poor HHs own 1.44 different livestock classes, compared to the 1.52 livestock classes that MD non-poor HHs own. There are no significant differences between the groups ($t(1348)=-1.470$, $p=0.142$)

Table 45: Number of livestock classes; contracted vs. non-contracted HHs

Contracted	Number of livestock classes		
	N	Mean	Std. Error Mean
Yes	360	1.61**	0.04
No	1147	1.47	0.02

The Levene test showed that the variances are not homogenously distributed ($p=0.003$). A subsequent Mann Whitney test showed that contracted HHs possess significantly more livestock classes then non-contracted HHs ($p=<0.05$).

4.10.2. Number of livestock (individuals) per class

Respondents were asked how many livestock they possess from each livestock class. As goats, sheep and bees were uncommon (see Table 8), only zebus, pigs, chicken and other poultry are included in the analysis. In the tables below, both, the percentage of HHs who do possess the respective livestock class are presented in %, and the number of households (n).

The percentages of HHs having livestock per group are compared in χ^2 tests. Furthermore, the number of livestock per livestock group were compared in t-tests.

Table 46: Number of animals per livestock class, male- vs. female headed HHs

Household head	Livestock class	%	Number of livestock (individuals)		
			N	Mean	Std. Error
Male (n=1066)	Zebus	52.35***	558	3.76	0.25
	Pigs	15.20*	162	1.70	0.64
	Chicken	84.15***	897		0.59
	Other poultry	25.80**	275	7.34	0.68
Female (n=256)	Zebus	31.25	80	3.59	0.40
	Pigs	10.55	27	2.37	0.32
	Chicken	69.53	178	10.29	0.86
	Other poultry	19.53	50	6.62	0.71

A significantly higher percentage of male-headed HHs possess zebus (p=<0.001), pigs (p=0.01), chicken (p=<0.001) and other poultry (p=0.005). Also, of those HHs who own livestock, male- headed HHs possess significantly more chicken (15.25 on average) than female-headed HHs (10.29 on average, p=0.001).

Table 47: Number of animals per livestock class, MD poor vs MD non-poor HHs

MD poor	Livestock class	%	Number of livestock (individuals)		
			N	Mean	Std. Error
Yes (n=448)	Zebus	48.66	218	3.22	0.51
	Pigs	10.49	47	2.21	0.21
	Chicken	80.13	359	15.18	1.19
	Other poultry	25.00	112	7.58	0.59
No (n=902)	Zebus	48.23	435	4.02*	0.20
	Pigs	15.96**	144	1.66	0.71
	Chicken	81.60	736	14.06	0.50
	Other poultry	24.28	219	7.16	0.83

A significantly higher percentage of MD non-poor HHs own pigs (16.0%) than MD poor HHs (10.5%, p=0.005). The percentage of MD poor and MD non-poor HHs that own zebus, does not differ significantly. However, MD non-poor HHs that do own zebus, possess significantly more zebus (4.02) than MD poor HHs (3.22, p=0.05).

Table 48: Number of animals per livestock class, contracted vs. non-contracted HHs

Contracted	Livestock class	%	Number of livestock		
			N	Mean	Std. Error
Yes (n=360)	Zebus	45.83	165	4.75***	0.48
	Pigs	45.83***	165	4.75	0.48
	Chicken	78.61*	283	15.08	0.78
	Other poultry	24.72	89	8.38	0.68
No (n=1147)	Zebus	42.55	488	3.42	0.24
	Pigs	12.38	142	1.57	0.72
	Chicken	70.79	812	14.20	0.64
	Other poultry	21.10	242	6.91	0.75

A significantly higher proportion (45.8% and 78.6%) of contracted HHs possess pigs and chickens, respectively than non-contracted HHs (12.4 %, p=<0.001 and 70.8%, p=0.01). Out of the HHs who possess zebus, contracted HHs possess significantly more zebus (4.8), on average, than non-contracted HHs (3.4, p=<0.001).

4.10.3. Number of NTFP used

Respondent HHs were asked how many different Non-Timber Forest Products (NTFP) they use (see Question 39 in DTBS questionnaire). A maximum of 11 items could be listed, the analysed variable is the sum of all listed NTFPs.

Table 49: Number of NTFP used; male vs. female-headed HHs

Household head	Number of NTFP used		
	N	Mean	Std. Error Mean
Male	1066	3.95*	0.05
Female	256	3.85	0.09

On average, male-headed HHs use significantly more NTFPs than female-headed HHs (4.0; t(1320)=0.89, p=<0.10).

Table 50: Number of NTFP used; MD poor vs. MD non-poor HHs

MD poor	Number of NTFP used		
	N	Mean	Std. Error Mean
Yes	448	3.89	0.07
No	902	3.93	0.05

Both MD poor and MD non-poor HHs use 3.9 different NTFPs, on average. There are no significant differences between the groups t((1348)=-0.447, p=0.65)

Table 51: Number of NTFP used; contracted vs. non-contracted HHs

Contracted	Number of NTFP used		
	N	Mean	Std. Error Mean
Yes	360	4.27^{***}	0.08
No	1147	3.86	0.04

On average, contracted HHs use significantly more NTFPs (4.3) than non-contracted HHs (3.9; t(1505)=4.25, p=<0.001).

5. DISCUSSION

The SAVA region in North-eastern Madagascar is by-far the most important vanilla growing region in the world (CNV International 2018, FAOstat 2018). Approximately 80% of Malagasy vanilla harvests stem from the SAVA region (CNV International 2018) and 82.6% of the representatively sampled HHs practice vanilla farming. The DTBS provides original data on the socio-economic background, living standards, land use, vanilla farming and marketing during a phase of the highest vanilla prices ever recorded (see Figure 2).

The majority of vanilla famers (63%) rely on an informal spot market supported by a complex network of middlemen and commission agents. We found that 15% of vanilla farmers had CFAs with vanilla business partners in 2016, integrating them more directly into the international vanilla value chain than non-contracted HHs. Empirically, we formed three different HH clusters based on the gender of the HH head (male-/female-headed), multidimensional poverty (poor/non-poor) and contracts with vanilla buyers (contracted/non-contracted). We saw that there are substantial differences between the different HH clusters in regards to their socio-economic background, HH composition, education, livelihood diversification, possession of assets, farm size, vanilla harvests and level of vertical integration into global value chains.

In the following section we will interpret and discuss both our presented descriptive results (Section 2) as well as the pairs of groups we compared (Section 4).

5.1 Socio-economic background, occupation and education

5.1.1 Household composition

Out of the sample of 1,350 HHs, the average age of HH heads (both, male and female) was 49.5 years. In Madagascar, there are large differences in HH composition between urban and rural areas (INSTAT 2011), and between poor and non-poor HHs (World Bank 2014). The average HH size from our sample (4.7 $\pm$ 0.6) is slightly higher than the projected regional average of 4.3 (INSTAT 2011) but smaller than the national average of 6.0 (World Bank 2014).

Between 1983 and 1993, HH sizes have declined in the SAVA region, from between 5.6 to 4.4 persons per HH (MAEP 2003). MAEP (2003) attributed this trend to economic hardship. However, these declines may also be explained by lowering fertility rates (INSTAT 2011), health, migration, cultural patterns surrounding intergenerational co-residence, home leaving, cohabitation, marriage and divorce (UNDESA 2017). This trend towards smaller HHs may give rise to an increase in the total number of HHs. In turn, more HHs may lead to a stronger fragmentation of productive resources, such as land, and to an increase in consumption of

natural resources, for example wood for housing construction and cooking (de Sherbinin et al. 2008, UNDESA 2017).
Especially true for rural HHs dependent on agriculture, changes in HH composition over time tend to influence decisions on land use and allocation of labour (de Sherbinin et al. 2008), which we also observed in further conducted research (Witherspoon, forthcoming). These are key questions, as we endeavour to understand the social and ecological interlinkages of vanilla cultivation and its impact on the local environment and producers.

All HHs had at least one child, a son or a daughter, with an average age of 13.9 and 13.4, respectively. Of the HHs surveyed, 21% were recorded to have one responsible adult person (HH head), with two responsible adults (HH head and spouse) in 78.5% of the sampled HHs. However, it was uncommon to have a grandparent of the HH head, or non-family member residing in the HH (see Table 4).

As shown in section 2.2.1 above, the mean age of females was 21.7 $\pm$ 0.37 years old and males 16.1 $\pm$ 0.29, respectively. Based on the data, we can describe the study population generally as youthful, and living in nuclear-family style HHs. The youthfulness of the population may lead to assumptions about an abundant availability of agricultural labour. However, agriculture would need to be seen as a viable livelihood option by young people in order to stay in rural areas and engage in vanilla production. On the one hand, rural- urban migration is common in Madagascar, particularly among young people (World Bank 2017). However, given the on-going high vanilla prices, on the other hand, vanilla cultivation may indeed be attractive to the youth.

Female-headed HHs accounted for 19% of the sampled HHs (see Figure 4), which is slightly below the national estimate of 20.6 % (World Bank 2014). Females who are heading the HHs, are mainly divorced, widowed or living without a partner due to other reasons. It comes as no surprise that female-headed HHs have significantly smaller HHs than male-headed HHs (see Table 10). As a male adult is missing in the HH, this may have a strong influence on the availability of agricultural labour and safeguarding of vanilla fields, which may in turn limit the agricultural productivity of female-headed HHs.
Female-headed HHs have the highest frequency of extreme poverty in Madagascar (World Bank 2014), and, particularly, children in one-parent HHs have the greatest exposure to poverty (Brown et al. 2015, UNDESA 2017). Consequently, female-headed HHs deserve special

attention in further research as they may be a marginalised and particularly vulnerable social group in our study region.

5.1.2 Education of household heads and children

In Madagascar, there are differences in education levels between poor and non-poor HHs, urban and rural areas, and male and female school children (INSTAT 2013, PASEC 2017).

The Malagasy literacy rate – the ability to read and write in Malagasy - of the population in rural areas of Madagascar older than 15 years old was 66.2% in 2013 (INSTAT 2013). Contrastingly, the literacy level of HH members in our sample is relatively high; with adults over 22 years old having a literacy rate of 80.7-85.8%. Similarly, the population older than 15 years of age, 67.7%-77.7%, was higher than the rate measured in the SAVA region in 2013 by INSTAT (2013). This gap could be explained by a differing survey methodology as INSTAT (2013) asked HH members if they were able to read and write a small text, while we asked if they could read and write in Malagasy in general. Additionally, we included HH members older than 22 years, as this is a maximum age where locals finish high school (PAESC 2017). On the contrary, INSTAT (2013) included all people over the age of 15. It is, however, possible that there have been positive developments in literacy rates in the SAVA region, which could be due to international donor support and the support of exporters and NGOs promoting sustainable vanilla farming that includes educational support.

Regarding the surveyed population older than 18 years of age, more males than females reported knowing how to read and write Malagasy (see Figure 5). In particular, female HH heads reported that they had received little education. Both in terms of school certificates (see Figure 23) and years of schooling (see Table 13) they received significantly less education when compared to their male counterparts. Similarly, concerning all ages above 10 years of age, more males than females had school certificates (CEPE and BEPC, see Figure 7), had attended vocational training (see Table 5), and knew how to speak, read and write in French (see Figure 6).

Conversely, when considering younger school children, the numbers show a different picture. Among children under the age of 10, slightly more females than males knew how to read and write Malagasy (see Figure 5) as well as French (see Figure 6). The gender difference in education over the course of time, as illustrated by the different age classes, corresponds to the gender differences in primary school success rates from 2004 in the whole of Madagascar (school success rated 2004–2009: more males than females; school success rates 2010–2014:

more females than males, UNESCO 2015). Likewise, the *Enquete auprès des ménages* in Madagascar in 2010 confirms that more girls than boys went to primary school (males 78.9%, females: 81.4%, INSTAT 2011).

These numbers show that the education of females has improved in Madagascar, particularly when comparing younger school children to female HH members older than 22 years. This might be attributed to efforts by the Malagasy Government to fight illiteracy; international funders who have given Madagascar a priority position (Waeber et al. 2016); and the promotion of gender equality in education (INSTAT 2013, Platteau 2018). Additionally, the overall schooling success rate in the SAVA region has improved in recent years (PAESC 2017). However, as vanilla prices have remained exceptionally high (see Figure 2), the need for agricultural labour in the SAVA region might be a reason that more girls than boys attend primary school. This is because a higher proportion of boys assist in HH vanilla farming (ILO 2011).

A significantly higher proportion of contracted HH heads have a primary school degree and lower secondary degree than non-contracted HH heads (see Figure 25). However, even though many vanilla exporters and NGOs support education in the SAVA region, an 'education effect' on the HH heads is unlikely, considering that the average age of HH heads is 47.5 years and that vertical integration, CFAs and their associated support are relatively new to the SAVA region. Thus, higher formal education of HH heads may lead *per se* to higher participation in CFAs. There are in fact many studies showing a relation between education of the HH head and contract participation by smallholder farmers, e.g. corn, rice and broiler farmers in Indonesia (Simmons et al. 2005), cattle fish farmers in Vietnam (Trifkovic 2014) and tobacco farmer in Tanzania (Sambuo 2014), among others.

Increasingly, the importance of educational support within sustainable development is acknowledged. Vanilla exporters and NGOs already set a focus on educational support. Studies show that school success rates have already increased in the SAVA region during the last few years (PAESC 2017).

Alongside the renewal of the national school curriculum planned for 2019 within the scope of the *Plan Sectoriel de l'Éducation* (PSE), WP 6 investigates the prerequisites of regionally adapted school curricula for the SAVA region. In order to contribute to the education quality, our second focus is on starting points for improved teacher trainings and teacher formation in the SAVA region.

5.1.3 Occupation, additional income-generating activities and livelihood diversification

Of the HHs surveyed, 93% of the HH heads and 80.2% of all HH members older than 18 years of age cited farming as their principal occupation (see Table 6). Other categories were rarely mentioned: some HH members were civil servants (1.5%) or entrepreneurs (1.0%). The figure in Madagascar as a whole looks similar - over 90% of the rural adult population is principally engaged in farming (INSTAT 2011, WFP 2015). Additionally, 67% of all HH heads also stated that in addition to their principal occupation they did not engage in any other income-generating activities (see Table 7). Of those that did engage in additional income-generating activities, small businesses, such as shops, and engagement in vanilla commissions were the most common. Our findings confirm the results of other studies that have found low levels of income diversification among Malagasy farmers, in general (Barrett et al. 2006, Minten and Barrett 2008, Neudert et al. 2015, Hänke et al. 2017), and farmers of the SAVA region more specially (Herimanga 2016).

The low level of income diversification may seem rational given the current high vanilla prices but might also be risky in the long-term. When considering the state of vanilla prices over the past 50 years, current prices are highly unstable (see Figure 2). Income diversification could hedge against periods of low vanilla prices.

Older empirical studies from sub-Saharan Africa have shown that farmers face substantial hurdles to engage in non-farm work (Barrett et al. 2001). Among them, are a lack of education and vocational training, weak infrastructure, lack of access to capital as well as market imperfections (Minten and Barrett 2008, Mitchel and Coles 2011). There is also evidence that poor HHs are mainly confined to low-return activities while better-off HHs, i.e. those possessing assets such as land, livestock and buildings, can benefit from high-return activities (Alobo Loison 2015). Income diversification is often positively correlated with well-being (Barrett et al. 2001, Neudert et al. 2015) .

The presented results show differing degrees of livelihood diversification among the sampled HHs. Female-headed HHs own fewer livestock classes than male-headed HHs (see Table 43), and reported less frequently to own zebus, chicken, pigs and "other poultry" (see Table 46). A lower proportion of MD poor HHs own pigs and zebus, in absolute terms, than non-MD poor

HHs (see Table 47). Additionally, contracted HHs possess more livestock classes (see Table 45), and larger amount of pigs and zebus, than non-contracted HHs (see Table 48).

Livestock is a key asset in Madagascar and is socio-culturally regarded as an indicator of wealth (Wüstefeld 2004, Klein et al. 2008). In semi-arid Madagascar, zebu farming is an essential part of the culture, society and history (Wüstefeld 2004), and contributes substantially to income and food security (Hänke and Barkmann 2017). However, in our study region, zebu husbandry plays an inferior role. Here, zebus are mainly used as drought animals in rice cropping; and few livestock is kept for sale (Kunz 2017). In fact, only 42% of all HHs kept zebus (mean: 3.7 heads). In contrast, 70.8 % of the surveyed HHs possessed poultry (see Table 8). Even though numbers are low, livestock could have a certain insurance function for local smallholders in times of shocks (cf. Hänke and Barkmann 2017), i.e. low vanilla prices, harvest losses or food scarcity (e.g. caused by cyclones). More in-depth research is needed here.

In addition to livestock and agricultural products, NTFPs can support livelihoods and subsistence needs of rural communities (Timko et al. 2010). NTFPs include all products taken from forested lands, such as roots, fruits, medicinal plants, resins, essential oils and fibres (Sunderlin et al. 2005). Generally, those products are mainly harvested by rural HHs and are used for both subsistence and cash income (Timko et al. 2010). NTFPs which are often open access resources, can serve as a safety net and a coping strategy. For example, by providing additional income or food contributions in low income periods or emergency situations (Sunderlin et al. 2005, Enfors and Gordon 2007, Shackleton et al. 2011).

Particularly, females could benefit from NTFPs and its trade could contribute to income equality as it is a low investment additional income activity (Shackleton et al. 2011). While such effects are not ruled out by DTBS results, male-headed HHs use a greater number of NTFPs than female-headed HHs in the project region (see Table 49).

5.2 Household assets and living standards

There are multiple indications that the socio-economic situation for the local population has improved in recent years. While in 2010 only 19.2% of the HHs in the SAVA region possessed a radio, 26.5% a TV, 14.2% a mobile phone and 19.7% a bicycle (INSTAT 2011), the situation has changed dramatically. In our study sample, 80.5% of the surveyed HHs had a radio, 33.3% had a TV, 49.1% had a mobile phone and 36.3% had a bicycle (see Figure 20).

Thus, the share of HHs possessing these specific assets has increased by 200-300% between 2010 and 2016. Additionally, the percentage of HHs possessing motorbikes (12.2) is high compared to other rural regions in Madagascar (INSTAT 2011).

In Madagascar as a whole, only 22.6% of the total population had access to a source of electricity in 2016, with rural areas particularly lagging behind (World Bank 2018). In our study area, 60% of sampled HHs had access to at least one source of electricity (Figure 16), which is most commonly solar panels. Even though only one of our 60 study villages was connected to an electricity grid, the share of rural HHs having access to electricity in our study region was relatively high in comparison to other regions in Madagascar.

Similarly, the share of HHs that used concrete as a foundation for their house (21.3%, see Figure 19) was high compared to other rural regions of Madagascar (INSTAT 2011)[7].

Approximately 71% of surveyed HHs had access to a latrine. However, 46% of these HHs shared the latrine with neighbours or other HHs (see Figure 17). These numbers are roughly in line with reports from PNAE (2016 as cited in ACAPS 2017), which reported that 78% of the rural population have access to latrines in the entire SAVA region. The share of latrines is high compared to other rural regions in Madagascar (UNICEF 2014). The latrines we found, however, are not improved according to the Millennium Development Goals (UNDP 2014). That is, they do not fulfil minimum hygiene standards (toilet with English seat, Turkish toilet, toilet with concrete or porcelain platform). Looking at Madagascar as a whole, 58.5% of the rural population have no access to improved toilets/latrines, instead open defecation is widely practiced (INSTAT 2011).

Due to many rivers and streams, high ground water level and high precipitation (MAEP 2003), water is abundant in the region. This is reflected in the short mean walking distance to the closest water source (7.6 $\pm$ 0.2 minutes; see above) for our sampled HHs. Some of our study villages also have protected fountains.

Even though water is abundant, HHs in many regions of Madagascar have poor access to safe drinking water as, for example, open defecation is commonly practiced by both livestock and humans (UNICEF 2014). Therefore, many water sources are contaminated with pathogenic bacteria, viruses and protozoa, which has contributed to Madagascar being ranked as the fourth

[7] In most villages many brand-new constructions can be observed, which we did not survey.

worst country in Africa with respect to safe water access (ibid). As open defecation is still present and most latrines are not of an improved standard, further efforts in sensitization and awareness of hygiene may be needed (cf. UNICEF 2014, WHO 2014).

While the SAVA region was among the poorest regions in Madagascar in 2002 (INSTAT et al. 2003) and in 2010 (INSTAT 2011), the situation may have improved today. We find strong evidence that the socio-economic situation has improved in the past few years in regard to assets, income and access to electricity.

5.4 Agriculture & Crops

Rice is by-far the most important staple crop in the study region. Hill rice (*tavy*) was mainly cited as a subsistence crop and rarely as a cash crop, while paddy rice was cited as important for both (cf. Figure 8a and Figure 8b). However, compared to other crops, *tavy* was of most importance to surveyed HHs and a common practice (practiced by >26% of respondents, see Figure 8a) despite its contribution to land degradation (Styger et al. 2007). As *tavy* is one of the principal drivers of deforestation in Madagascar and leads to upland degradation, it is an illegal activity (Jarosz 1993, Styger et al. 2007). However, *tavy* might play a more important role in remote villages not covered in this survey (Zaehringer et al. 2015).

We found that coffee and cloves are relatively unimportant as cash crops. Coffee was cited by 22.9% of the respondents and cloves by 16.6%, respectively. Likewise, coffee is more important as a subsistence crop than as a cash crop (cf. Figure 8a and Figure 8b). Yet, these crops play a more important role elsewhere in Madagascar (Danthu et al. 2014). In fact, cloves and coffee makeup for 6.8% and 0.7% of all Malagasy export value, respectively (OEC 2017).

5.5. Land conversion and deforestation

In our study region, irrigated rice is both an important cash and subsistence crop. None of the survey respondents stated that irrigated rice was converted to a vanilla plot (cf. Figure 11 and Figure 12) indicating that irrigated rice fields are very valuable.

While the yearly upland rice production (*tavy*) in North-eastern Madagascar was stable between 1995-2011, the area of irrigated rice was, and still is, slowly expanding (Zaehringer et al. 2015). However, with rotating fallows, as part of the shifting cultivating practice, the total area of secondary vegetation following upland rice farming is still increasing at the cost of forestland (Zaehringer et al. 2015). This indicates that land use intensification and agricultural expansion through *tavy* may occur simultaneously (Zaehringer et al. 2015).

Promoting a system of sustainable rice intensification (SRI) in already established irrigated rice fields, is discussed as a way to improve livelihoods of Malagasy farmers and reduce their dependency on *tavy*, thereby conserving the remaining forests (Stoop et al. 2002). However, while SRIs have shown promising results from an agronomic and ecological point of view, they have shown very disappointing adoption rates by Malagasy farmers, mainly due to the its high cost in terms of labour requirements (Moser and Barrett 2003).

Traditional farming practices, such as *tavy*, are often blamed for deforestation processes in Madagascar (Kull 2000). During the French colonial period, *tavy* was cited as the main source of deforestation in the tropical east of Madagascar (Jarosz 1993). Even though forest loss in our study region may also be attributed to *tavy*, vanilla plantations can also be a direct conversion from natural forest. In order to convert a forest into a plantation, understory shrubs are cut and then replaced with vanilla, and other trees are cut to provide light for the vanilla. In fact, this was practiced by 23% of our survey respondents (see Figure 12). On average, 30.6 % of respondents reported that they planted vanilla on land that was currently fallowing, and 8.8% converted *tavy* land (see Figure 12).

If farmers owned forestland and wanted to plant vanilla, they would not burn the forest. Instead, they would opt to plant vanilla below the existing trees. This would most likely have negative effects on the local biodiversity and ecosystem services. However, this outcome is probably more biodiversity friendly than burning the forest for *tavy* (cf. Steffan-Dewenter et al. 2007). Thus, the role of vanilla is ambiguous. Vanilla cultivation could be beneficial for biodiversity if vanilla plantations are established on open (burnt) land use types (fallow/*tavy* land) leading to more trees in the fields and higher tree cover in the landscape. Such an increase of tree cover in the landscape might have benefits for both biodiversity and ecosystem services in return. Conversely, the establishment of vanilla plantations within natural forests might lead to a reduction in ecological diversity and a local loss of biodiversity and ecosystem services.

However, the current high vanilla prices could also influence land use decisions beyond vanilla. High prices could motivate farmers to focus on vanilla and buy rice with the money received, lowering the land used to plant rice in *tavy*. In the 1990s, when vanilla was a key crop and received high prices, the vanilla growing communes saw in fact less forest loss than, for example, coffee growing communes. This could indicate that if a crop is sufficiently profitable, farmers focus on existing plantations and do not cut forests to grow other crops (Moser 2008).

However, this effect might be impeded as farmers in the SAVA region aim for rice subsistence even if vanilla, as a valuable cash crop, is available (Laney and Turner 2015). This might be caused by farmers being risk-averse, which is common among smallholder farming communities (Wolgin 1975, Ghadim et al. 2005), and other areas of Madagascar (Hänke et al. 2017).

Furthermore, region-wide deforestation rates increased continuously during the period between 1990-2014 (Arruda-Ferreira 2018), while vanilla prices have shown both greatly increasing and decreasing trends during that period (see Figure 2). In 1953, two thirds of the SAVA region were still forested (65%, Vieilledent et al. 2018) but forest cover went down to 31% by 2014 (Arruda-Ferreira 2018). Annual deforestation rates of 0.95% were observed between 2010 and 2014, a rate 2-4 times higher than between 1990 and 2010 (ibid). Given the fact that the vast majority of the surveyed population use wood (92.2%) and charcoal (14.2%) as their primary energy source for cooking (see Figure 16), and timber for house construction (see Figure 19), the subsistence use of wooden resources most likely contributes to regional deforestation. This is particularly important considering that the Malagasy population has quadrupled in the past 50 years (World Bank 2015b).

These rapid changes have occurred despite the fact that most forests in Madagascar´s eastern escarpment receive a great deal of attention from international donors and conservation organisations (Moser 2008). Conservation approaches in Madagascar often focus on protected areas excluding any kind of resource extraction by local land users (Gardner et al. 2018). Accordingly, conservation in Madagascar has been criticised as inefficient (Scales 2014, Randriamamonjy et al. 2016), thus resulting in high costs for people living in and around protected areas as adequate compensation is mostly missing (Ferraro 2002, Poudyal et al. 2018).

The link between deforestation and biodiversity, on the one hand, and vanilla cropping and *tavy*, on the other hand, may turn out as a crucial challenge for further research in the Diversity Turn Project. Which are the factors making a vanilla plantation "biodiversity friendly"? How do different kinds of vanilla plantations (forest converted vs. open land use type conversion) compare in their biodiversity value? How does vanilla compare to other land use types such as irrigated rice, herbaceous fallow, woody fallow, forest fragment and primary forest? Which social and economic factors influence land use decisions resulting in the studied land use patterns and the associated biodiversity values?

5.6 Vanilla farming and sales

Vanilla is by-far the most important cash crop in the region with 83% of the surveyed HHs cropping vanilla (see Figure 4). However, there were significant differences among the HHs we sampled regarding vanilla fields sizes, quantity of vanilla produced, proportion of sales in green and black vanilla, in which month vanilla was sold, prices received and to which business partners it was sold to.

Green vanilla can only be stored for ~1 week without a decrease in quality (Correll 1953). Hence, farmers either sell green vanilla immediately after harvest or transform it to black vanilla. The traditional curing process takes several weeks and involves a short immersion in hot water, and an extended period of fermentation and sun drying (Havkin-Frenkel and Frenkel 2006). Once black vanilla is sufficiently dry, it can be stored either in wax wrapping paper or in vacuum packages[8] (ibid). Often, farmers initiate the transformation process and sell black, but not completely dried vanilla, a few weeks after harvest.

The official market opening dates in 2016, which were set by the regional government, were June 20th in the littoral zone (low altitude), July 1st in the intermediate zone and July 15th in the mountainous zone. The Antalaha, Vohemar and Sambava districts are predominantly in the littoral and intermediate zone, while the western Andapa district is mostly in the mountainous zone[9]. In Madagascar, it is forbidden by law to sell green vanilla before the official market opening. However, many farmers are afraid of theft from their plantations (see Section 4.8.3. Fear of crime). Consequently, many farmers harvest and sell green vanilla before the market opening, particularly under the high price regime covered by this study. Another reason for early harvest might be the need for fast cash as rice stocks and cash are often depleted during vanilla harvest periods (Laney and Turner 2015, Herimanga 2016). Consequently, the official dates regulating green vanilla harvesting and marketing may be too restrictive with respect to the spatial and temporal variability of vanilla flowering and maturation.

---

[8] Vacuum packaging has been forbidden by law in Madagascar. However, according to our own observations it is still practiced by many vanilla farmers.

[9] The Andapa region (western side of our study region) is around 500 m above sea level and has a different climate then the littoral zone. Therefore, the maturity as well as the harvest dates for green vanilla differ here.

A small share of HHs sold their vanilla already in May 2016 (see Figure 28, Figure 29 & Figure 30[10]) when the green fruits were immature. Prices were lowest in May and steadily increased until August 2016 (see Figure 14a). While very few HHs sold vanilla in July and August, when the prices of green vanilla were at their highest, most of the HHs sold in June (see Figure 28, Figure 29 & Figure 30). The picture is even more dramatic when looking at black vanilla specifically: HHs who sold in July 2016 had most likely already harvested their vanilla in May 2016 or earlier, and the prices received were four times less than prices in March 2017 (see Figure 14b).

Contracted HHs received higher prices in June and July 2016 (most likely in line with legal market opening) and sold significantly bigger quantities of both green (see Table 30) and black vanilla (see Table 33). They also have significantly larger field sizes than non-contracted HHs (see Table 24). On the contrary, only 65% of female-headed HHs practiced vanilla farming, and of those who sold, quantities of both green and black vanilla were significantly smaller than those of male-headed HHs (see Table 28 & Table 31).
An in-depth discussion for the reasons why HHs sold green and/or black vanilla can be found in the Synthesis below.

5.7 Vanilla buyers/business partners

Looking at our representative sample (n=1350), 63% of vanilla farmers sold their vanilla to commission agents (*rabatteurs* & commissionaires). Commission agents are among the first buyers to enter the villages to source vanilla and a large share of vanilla sold to commission agents is transacted before the official market date (Lepêcheur 2017 & WP4 survey data).
These types of buyers come directly to the village and offer their services at the farm gate. In fact, both a majority of male- as well as of female-headed HHs sell to commission agents (~ 63%). Only ~10% sell to collectors and ~8% sold directly to exporters. There were no significant differences between male- and female-headed HHs.

A significantly higher proportion of MD poor HHs sold to commission agents than MD non-poor HHs (p=<0.05). Similarly, a significantly higher proportion of MD poor HHs were found to have sold to exporters (9.7%) than MDP non-poor HHs (6.2%, p=<0.05). This finding

[10] The share of HHs who harvested and sold vanilla immature might be higher than indicated. As it is illegal, respondents may have underreported sales ahead of official dates.

suggests that some of the MD poor HHs sought out exporters at their premises in nearby towns to offer their vanilla at the exporter's gate. This helps to capture bigger profit margins with the farmer circumventing commission fees that, otherwise, would be paid to middlemen.

A significantly higher proportion (66.4%) of non-contracted HHs sold to commission agents than contracted HHs (41.9%, p=<0.005). Conversely, a significantly higher proportion of contracted HHs sold to collectors than non-contracted HHs (p=<0.005). These findings reflect the fact that collectors represent an exporter or preparator at the village after market opening; the time most of the contracted HHs also sold their vanilla (see Figure 30).

Some collectors work for exporters and for preparators, who run contract-farming schemes (CFAs). Thus, it comes as no surprise that a higher proportion of contracted HHs sell to exporters (p=<0.001) and preparators (p=<0.005) than non-contracted HHs. Contracted vanilla farmers also received higher prices per green vanilla kg (see Figure 30) and black vanilla (see Figure 40). Additionally, many contracted farmers also receive non-monetary benefits form their business partners (DTBS survey data).

As shown in Figure 4, 15% of all vanilla farmers were in CFAs. To date, contract farming is still relatively new and represents a minority phenomenon across our study region.

5.8 Trust and Fear of Crime

5.8.1. Trust towards collector and big companies

Trust and social capital are very important in the presence of market imperfections as they facilitate economic transactions, thus, reducing transaction costs (Alesina and Ferrara 2002, Johnson and Mislin 2011). However, formal contracts between vanilla buyers and vanilla farmers are rare. In the absence of formal contracts, trust can act as a substitute for them (Trebbin 2014).

When comparing the levels of agreement, between male- and female-headed HHs, with the statement *"I do trust vanilla collectors"*, we found that there were no significant differences between both groups. However, when comparing the average levels of agreement with the statement *"I trust people from big companies that buy my vanilla"*, male-headed HHs agreed significantly more with the statement than female-headed HHs (p=<0.01). However, the mean difference was small (male-headed: 3.31; female-headed: 3.14). As average values reported by both HH clusters were close to 3, "neither agree or disagree", for both types of buyers, there is (i.) weak evidence that both groups do or do not trust companies and collectors, and (ii.) there is only moderate evidence for differences in trust towards vanilla collectors and companies between male- and female- HH heads.

Furthermore, when comparing the average levels, between MD poor (3.21) and MD non-poor HHs (3.12), of agreement with the statement *"I trust vanilla collectors"*, we found no significant differences between both groups. Likewise, when comparing the average levels of agreement with the statement *"I trust the people from big companies that buy my vanilla",* there were no statistically significant differences between MD poor HHs (3.27 on average) and MD non-poor HHs (3.31). The levels reported for both groups were slightly higher but close to 3, which does not give a strong indication of or against trust towards collectors and big enterprises.

As interactions between companies and vanilla farmers are not frequent (sometimes only once a year), it may be difficult to build the expectation that the business partner will cooperate (Alesina and Ferrara 2002), which is a key prerequisite for trust to exist (Ben-Ner and Putterman 2009, Johnson and Mislin 2011).

Comparing the average reactions of contracted and non-contracted HHs to the statement *"I trust vanilla collectors"*, contracted HHs (a score of 3.24) agreed significantly more with the statement than non-contracted HHs (a score of 3.11) ($p=<0.05$). The average scores for both groups were close to 3 and the mean difference was small. Similarly, when comparing the average levels of agreement with the statement *"I trust the people from big companies that buy my vanilla"*, contracted HHs (3.57) agreed significantly more with the statement than non-contracted HHs (3.17, $p=<0.001$). Here, the mean difference was larger, and the average score given by contracted HHs towards the statement related to big enterprises is higher than the one reported towards collectors (3.57 vs. 3.24). Thus, contracted HHs have more trust in "*big companies*" thank in "*collectors*".

These results are in line with Ben-Ner and Putterman (2009) and Johnson and Mislin (2011), who argue that trust is based on an expectation of trustworthiness, which can happen once successful interactions have happened. As contracted HHs have already shown that they trust the business partner, by having a contract with them, this might influence their behaviour within the value chain. The fact that contracted HHs reported higher levels of trust towards big companies can be explained by Wilson (2000), who showed that positive previous business interactions enhance trust. Unlike the collectors, big companies offer contracts to farmers that are more comprehensive, and when both parties comply a trust building process starts. International companies also have extension workers who train vanilla farmers in contract compliance ,thus, there is more interaction. This result is particularly important as the aim of companies is to build long-term trust relations with vanilla farmers. The presented findings indicate that CFAs might positively affect trust dynamics. Building social capital, and especially trust, is necessary to create strong and reliable commercial networks, that do not only support a revenue growth for both parts but also respond effectively to market demands (Wilson 2000).

5.8.2 Fear of Crime

Victimisation surveys are often conducted with the purpose of analysing crime rates and measuring how citizens feel about security and safety. It has been shown that fearing crime negatively affects life quality, increases social inequalities and decreases levels of social capital (Morash 2006). Between 38-44% of our surveyed vanilla farmers reported that they had been victims of vanilla theft (see Figure 44).

When comparing the average levels of agreement with the statement "*I think my plot is constantly threatened from theft*", male-headed HHs gave a score of 4.11, and female-headed HHs 4.16. Thus, both groups "agree" with the statement to a similar degree. In similar studies, however, women reported higher levels of fear towards crime than men (Morash 2006, Rader 2017).

No significant differences were found, when the average levels of agreement with the statement "*I think my plot is constantly threat from theft*" were compared between MD poor (4.15) and MD non-poor (4.10) HHs,. In the literature, it has been found that poorer individuals fear crime more than richer individuals as they often live in more dangerous and isolated neighbourhoods and are, therefore, more exposed to crime (Rader 2017). However, in the case of the villages we surveyed, both the MD poor and MD non-poor HHs shared similar living spaces, thus, our results matched the given context. Moreover, as both groups also had similar plot sizes (see Table 23) and sales of green (see Table 29) and black vanilla (see Table 32), their perceptions towards crime might have, indeed, been similar.

On average, contracted HHs agreed more with the statement *"I think my plot is constantly threat from theft"*. Contracted HHs gave a higher average score of agreement (4.20) to the statement than non-contracted HHs (4.09), but the mean difference was marginal. However, the fact that contracted households had significantly larger plots (see Table 24) and harvests of both green (Table 30) and black vanilla (see Table 33) than non-contracted HHs, might explain why they were significantly more afraid of theft. Furthermore, as contracted HHs had a contract with a buyer, they might have been more afraid of losing their yield, as that would mean they would not comply with the concluded contract.

Based on our survey, we find that fear of crime is common among vanilla farmers and many farmers have been victims of vanilla theft. This fear most likely has a negative impact on local livelihoods and social capital. In the specific case of vanilla, this fear might have additional impacts on farmers' production decisions, such as deciding when to harvest or when to sell. Thus, it is important that the government and companies, that are interested in building business relationships with farmers, consider the role of trust and fear of crime when developing their programs or networks with the communities.

Analysing the importance of trust and the impacts of crime shapes the research of WP5. We aim to analyse the impact of those variables on the behaviour of farmers their interaction with other community members and other actors of the vanilla value chain. We believe that by studying these key variables we can contribute in providing a better understanding of what motivates certain actions of farmers and how they can potentially be changed towards more beneficial outcomes.

5.9 Synthesis

As our overall research goals are related to social diversity (i.e. gender, age, social status), poverty and the influence of contract farming on smallholder farmers, we finally discuss the presented findings in relation to those three groups we compared, i.e. male- and female- headed HHs, MD poor and MD non-poor HHs, and contracted and non-contracted HHs.

5.9.1 Gender and the vanilla value chain

This section compares male- and female-headed HHs; their similarities, differences, and implications for profitable integration into vanilla value chains. We supplement the discussion by drawing on global, regional and countrywide analyses on gender and agriculture, value chains and rural livelihoods.

A practical means of identifying gender inequalities is to look at differences in how men and women access opportunities or rights, resources and decision-making powers. According to the World Bank (2015) 20.6% of HHs in rural areas are female-headed. Nationally, 76.4% of economically active women (49.1% of economically active people are women) work in agriculture (FAO 2010, World Bank 2015b). Despite the high involvement of women in agriculture, the data presented shows gender disparities among male- and female-headed vanilla producing HHs, at various nodes of value chain participation, such as in production, processing and marketing.

Male-headed HHs tend to perform better than their female counterparts across indicators of HH size (the bigger the size, the larger the labour availability), educational attainment, vanilla field size, received price for green vanilla during market peaks, quantity of green and black vanilla sold, assets, number of livestock, and CFAs with vanilla traders, i.e. direct vertical integration in value chains. Specifically, a significantly lower proportion of female-headed HHs participate in CFAs than male-headed HHs ($p=0.002$, χ^2 test).

Regarding the marketing of vanilla, both male- and female HH heads stated that better pricing was a primary reason to sell black vanilla. However, significantly more men than women cited tradition, while more women than men cited the possibility for stocking, as reasons for selling black vanilla (see Figure 32). Furthermore, perceived lack of vanilla processing knowledge, not enough harvest, theft, lack of material for vanilla processing and immediate need for money were cited by participants in both groups as reasons for not selling black vanilla. Yet, significantly more women than men perceived selling black vanilla as "*not economically worthy*" and a "*lack of labour*" as reasons not to sell black vanilla, confirming the lack of a male adult partner in the HH (see Figure 33).

The fact that a significantly lower proportion of female-headed households sold black vanilla than their male counterparts (see Figure 31) provides a small window into the realities for female HH heads, who are vanilla farmers. In order to produce 10kg of black vanilla, a farmer needs around 40 - 50kg of green vanilla. To have good quality black vanilla, a farmer needs to ensure that the beans are fully ripe. Ensuring this requires day and night surveillance of the vanilla field or hiring security guards for approximately 2-3 months before harvest to reduce theft. Many women are unable to meet these conditions, because they lack the necessary labour force (see Figure 33). They are often unable to support the harsh conditions for securing their fields themselves in addition to domestic duties and/or do not have the resources to pay for additional labour. As female-headed HHs often have significantly smaller fields (see Table 22) and vanilla harvests (see Table 28 & Table 31) than male-headed HHs, production is not large enough to offset the investment of hiring additional labour. The opportunity costs (labour, time input, risk of theft) and the price differential, based on the conversion rate of green to black vanilla, may mean that the sale of black vanilla is not attractive for them. Thus, selling processed vanilla is judged unprofitable by female HH heads (see Table 33).

Based on the presented data, we conclude, that female-headed HHs are weakly integrated into the vanilla value chain. In contrast, male-headed households are better integrated into the vanilla value chain, as they sell larger quantities (see Table 28 & Table 31) and a significantly higher proportion conclude contracts.

Value chain research has shown that gender (male/female) participation is influenced by socio-cultural, political, economic and environmental factors (Mitchel and Coles 2011, Pierce Colfer et al. 2016). These include access rights and decision-making power over natural resources (e.g. land), physical nature of work, social and specific business norms and values, literacy, domestic responsibilities (e.g. cooking), differences in input use (mechanization vs. traditional), distance to fields, and access to markets and capital (FAO 2010, GIZ 2013). Often excluded from horizontal (among producers) and vertical (with other actors) linkages in the value chain, women's bargaining power is limited (GIZ 2013). However, the degree to which these factors affect women is context specific and largely dependent on the product and the cultural setting (Pierce Colfer et al. 2016).

The findings respond to the first level of analysis and describe the conditions that define inequalities between female and male HH heads in the vanilla value chain[11]. While the data presented highlights inequalities, the second level of analysis will be to ask why these conditions exist and thrive, requiring a causal analysis. For instance, why do female-headed HHs have less land, smaller vanilla fields and lower production? Moncrieffe (2004), as well as many other researchers, argued, "*Power relations must figure significantly in explanations of poverty and inequality*" since power imbalances in social relations create and reinforce unequal access to disadvantages and benefits (Moncrieffe 2004).

[11] However, as stated in the introduction, our analysis covers gender complexity only partly as intra-household inequalities are not covered by this survey.

Agriculture, including vanilla production, is the principle source of livelihood for rural households in Madagascar (FAO 2010). We may conclude that access to land, as the most important productive resource, secures livelihoods and affects the social and economic status and position of both men and women (Arens 2011). In other words, access to land affords men and women capabilities/capacities to achieve wellbeing (Sen 1999), with access to land functioning as a natural source of power (Morriss 2003, Boonstra 2016).

5.9.2 Multidimensionally poor households

Poverty is, in particular, a rural problem in Madagascar. In 2010, 82.3% of the rural population was poor compared to 54.2% of the urban population (INSTAT 2011). More specifically for the SAVA region, 78.7% of the rural population was poor in 2010 compared to 38.9% of the urban population (ibid). However, poverty is complex and there are several methods and indicators to measure it. There are absolute, relative and subjective measures, monetary and non-monetary indicators, and self-estimations (Ravallion 1994, Coudouel et al. 2002, Alkire et al. 2015).

Especially true for agrarian societies, income is highly seasonal, there are great price fluctuations for cash crops, and most rural HHs do not keep written records of cash or labour flows (Deininger et al. 2012). Thus, income, expenditure or consumption data, that are needed for absolute poverty measurements, are difficult to collect in recall surveys (Wiseman et al. 2005, Deininger et al. 2012, Ton et al. 2018) such as the DTBS. Therefore, we opted for the MPI framework, which is a relative poverty measurement based on living standards, education and health (Alkire et al. 2015, UNDP 2018). However, income is not considered. Particularly since many CFAs include benefits on education and health for contracted vanilla farmers, the MPI framework appeared as an appropriate measurement for poverty. However, although 33% of our sampled HHs were identified as multidimensionally poor (see Figure 4) we found, in fact, few differences between MD-poor and MD non-poor HHs. Compared to contracted/non-contracted and male-/female-headed HHs, MD poor/non-poor HHs were a weak predictor of differences for most sampled variables.

In this contribution, we used the MPI framework to measure poverty at the HH level including male and female individuals and provided a pooled poverty value for the HH. The international cut-off for the MPI value is $c \geq 0.33$, that is, a HH is defined as MD poor if it is deprived in at least 1/3 of all indicators (see above, Alkire et al. 2015, UNDP 2018). However, the c-values have also been shown to be a promising indicator to compare poverty within and among different groups, including analysis of inequalities of individual HH members (Alkire et al. 2015). The comparisons of HHs and HH members in relation to the same or other HHs will be a next step of our MPI analysis.

For a more in depth-analysis of poverty, labour, cash-flows and income and expenditure of vanilla smallholder farmers, WP1 and WP4 are conducting a longitudinal survey from September 2017-October 2018 (n=140 households, *bi-weekly* data acquisition).

5.9.3. Contracted households

There is an increasing body of knowledge documenting substantial benefits for small-scale farmers who conclude CFAs in other regions (Oya 2012, Barrett et al. 2012, Narayanan 2014), and in Madagascar specifically (Minten et al. 2009, Bellemare 2010, 2012).

As we saw, for the case of vanilla farmers in Madagascar, contracted HHs received significantly higher prices for green vanilla than non-contracted HHs (see Figure 30) as well as for black vanilla (see Figure 40). In addition, contracted farmers received several non-monetary benefits from contract partners, i.e. (partly) access to credit, support for income diversification, technical assistance, vocational training, support in education and free health insurances (forthcoming).

Yet, as we saw, HHs that conducted contracts with exporters or collectors seemed to have specific HH portfolios. Contracted HHs had significantly more HH members than non-contracted HHs (see Table 12), which tended to provide them with a larger workforce and more agricultural labour. Likewise, contracted HHs had higher education levels both in years of schooling (see Table 16) and in terms of school certificates ($p=0.001$, see Table 26), which may have given them more cognitive flexibility, bargaining power and reliability. Additionally, they tended to live significantly longer in the village and have significantly more experience in vanilla farming ($p= <0.001$, see Table 27). Furthermore, and probably most importantly, contracted HHs also had significantly larger vanilla plots (see Table 24) and higher harvests of green and black vanilla than non-contracted HHs ($p=<0.001$, see Table 30 & Table 33). Exporters and collectors require large quantities and high-quality vanilla and are binding vanilla farmers through contracts. Contracted HHs most likely have the necessary labour and the resources available to protect their fields from theft and are rewarded through better prices as wells as other non-monetary benefits. Contracting exporters may focus on better educated and larger farmers.

In fact, most contracted HHs sold their vanilla after market opening (see Figure 30) and the higher prices they received were possibly due, among other reasons, to a higher vanilla quality (vanillin content). Additional reasons could include price primes, if they also had additional certifications (private voluntarily standards, see introductory explanations above), discounts for illegal early vanilla, and discounts for vanilla sold early to pay off debt. According to the DTBS, price primes were between 5,000-10,000 Ariary per kg green vanilla – a small amount given the price level in 2016.

Contracted HHs also had significantly more assets (p=0.001), which are commonly used as indicators of wealth in development studies (Alkire and Housseini 2014, UNDP 2018), as well as livestock, i.e. zebus and pigs (see Table 48). This points us to the subject if contracted HHs engage in CFAs because they are wealthier or are they wealthier because they benefit from the CFAs? This is a crucial research question for further research by the Diversity Turn project. We find indications that contracted HHs were wealthier than non-contracted HHs even prior to concluding their contracts. As CFAs are, on average, relatively new they cannot have influenced the education level of male HH heads (average age 49.5 years), experience in vanilla farming (average years 15.3) or the size of HHs. On the other hand, ownership of assets and livestock could be a result of lucrative vanilla contracts including significant higher prices. However, if HHs with CFAs had been wealthier prior to the contracts on average, CFAs could further increase social inequalities.

As we saw, a significantly lower proportion of female-headed HHs participated in CFAs (p=0.002) than male-headed HHs. Thus, there may be a risk that marginal communities are excluded from profitable vanilla value chain integration and this should be monitored carefully in the future. In fact, in smallholder farming settings, there is evidence that mainly HHs with particular large field sizes (Ragasa et al. 2018, Ton et al. 2018), male individuals and local elites tend to benefit from profitable market integration (Genicot 2002, Basu 2007).

One of the central research questions by the ‘Diversity Turn’ research project is “Which HHs benefit from the vertical market integration in global vanilla value chains?”. Further research by WP1 and WP4 will study wealth as a function of how many years contracted farmers are in a contract and if it has an impact on wealth or other indicators (education, income, harvest, assets). In other words, are only wealthy HHs benefiting from CFAs, and, if so, how does this influence social (in)equalities?

6. CONCLUSION

With little information on the livelihoods of vanilla farmers available prior to this survey (exception: Herimanga 2016), the DTBS in-depth insights into the socio-economic context of vanilla farming in the SAVA region and provides baseline data for the Diversity Turn research project.

North-eastern Madagascar is the most important vanilla growing region globally. Here, 83 % of the sampled households practice vanilla farming. While the SAVA region and vanilla farmers were characterized as poor in the past, the situation may have improved today. In 2016, there was a dramatic rise of vanilla prices, which is the period we cover retrospectively in this survey. Given the high global market prices, vanilla is now Madagascar's most important export commodity and more than 80% comes from the SAVA region. We find evidence that the socio-economic situation has regionally ameliorated in terms of education, access to electricity, ownership of assets and in particular vanilla prices received. However, with high prices, pandemic vanilla theft has appeared further burdening Malagasy vanilla farmers.

The majority of farmers (63%) sell their vanilla on an informal market to commission agents that are part of a complex network of middlemen. Yet, as global demand for natural and certified vanilla has increased, vanilla collectors and exporting companies offer CFAs to vanilla farmers. In our sample, 15 % of the vanilla farmers had CFAs cutting out middlemen.

We find evidence that there are substantial benefits for vanilla farmers with CFAs, *inter alia*, significantly higher prices during market peaks for green and black vanilla. However, these benefits are distributed unequally among the local population. Female-headed HHs profit less from CFAs than male-headed HHs, as a significantly lower share have concluded such agreements. Contracted HHs have significantly more agricultural labour in the household, better education, are more experienced in vanilla farming, and have larger fields and bigger harvests of vanilla than non-contracted households.

We find indications that contracted HHs may already have been better-off prior to the conclusion of a contract. If only wealthier households benefit from contract schemes, social inequalities will most likely increase.

REFERENCES

ACAPS. (2017). Briefing Note: Tropical Cyclone Enawo in Madagascar. Geneva: ACAPS. Retrieved from https://www.acaps.org/sites/acaps/files/products/files/20170313_acaps_briefing_note_madagascar_tropical_cyclone.pdf

Agresti, A. (2007). *An Introduction to Categorical Data Analysis* (Second Edition). London: Wiley. http://doi.org/10.1002/0471249688

Alesina, A., & Ferrara, E. La. (2002). Who trusts others? *Journal of Public Economics*, *85*(2), 207–234. http://doi.org/10.1016/S0047-2727(01)00084-6

Alkire, S., & Foster, J. (2011). Counting and multidimensional poverty measurement. *Journal of Public Economics*, *95*(7–8), 476–487. http://doi.org/10.1016/j.jpubeco.2010.11.006

Alkire, S., & Housseini, B. (2014). Multidimensional Poverty in Sub-Saharan Africa : Levels and Trends, Working Paper 81. Oxford: University of Oxford. Retrieved from https://ophi.org.uk/wp-multidimensional-poverty-in-sub-saharan-africa-levels-and-trends/

Alkire, S., Roche, J. M., Ballon, P., Foster, J., Santos, M. E., & Seth, S. (2015). *Multidimensional poverty measurement and analysis*. (S. Alkire, J. M. Roche, P. Ballon, J. Foster, M. E. Santos, & S. Seth, Eds.). Oxford: Oxford University Press.

Alkire, S., & Santos, M. E. (2010). Acute Multidimensional Poverty: A New Index for Developing Countries. United Nations Development Programme Human Development Report Office Background Paper No. 2010/11. Oxford: Oxford Poverty & Human Development Initiative (OPHI). Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1815243

Allnutt, T. F., Asner, G. P., Golden, C. D., & Powell, G. V. N. (2013). Mapping recent deforestation and forest disturbance in northeastern Madagascar. *Tropical Conservation Science*, *6*(1), 1–15. http://doi.org/10.1177/194008291300600101

Alobo Loison, S. (2015). Rural Livelihood Diversification in Sub-Saharan Africa: A Literature Review. *The Journal of Development Studies*, *51*(9), 1125–1138. http://doi.org/10.1080/00220388.2015.1046445

Anseeuw, W. (2012). Contract Farming: Why? What? How? *Contract Arrangements (Vol. 1*). University of Pretoria and CIRAD. Retrieved from http://www.globalbioenergy.org/uploads/media/C1_Contracting Arrangements_.pdf

Arens, A. M. J. (2011). *Women, land and power in Bangladesh: Jhagrapur revisited*. Ph.D. Thesis. University of Amsterdam. Retrieved from http://hdl.handle.net/11245/1.360601

Arruda-Ferreira, T. (2018). *Spatial-temporal patterns of deforestation in Northeast Madagascar*. Master Thesis. University of Goettingen.

Barrett, C., Reardon, T., & Webb, P. (2001). Nonfarm income diversification and household livelihood strategies in rural Africa: concepts, dynamics, and policy implications. *Food Policy*, *26*(4), 315–331. http://doi.org/10.1016/S0306-9192(01)00014-8

Barrett, C. B., Bachke, M. E., Bellemare, M. F., Michelson, H. C., Narayanan, S., & Walker, T. F. (2012). Smallholder Participation in Contract Farming: Comparative Evidence from Five Countries. *World Development*, *40*(4), 715–730. https://doi.org/10.1016/j.worlddev.2011.09.006

Barrett, C., Marenya, P. P., Mcpeak, J. G., Minten, B., Murithi, F., Oluoch-kosura, W., Randrianarisoa, J. C. (2006). Welfare Dynamics in Rural Kenya and Madagascar. *Journal of Development Studies*, *42*(2), 248–277. https://doi.org/10.1080/00220380500405394

Basu, K. (2007). Coercion, contract and the limits of the market. *Social Choice and Welfare*, *29*, 559–579. http://doi.org/10.1007/s00355-007-0245-0

Bellemare, M. F. (2010). Agricultural extension and imperfect supervision in contract farming: evidence from Madagascar. *Agricultural Economics*, *41*(6), 507–517. http://doi.org/10.1111/j.1574-0862.2010.00462.x

Bellemare, M. F. (2012). As You Sow, So Shall You Reap: The Welfare Impacts of Contract Farming. *World Development*, *40*(7), 1418–1434. http://doi.org/10.1016/j.worlddev.2011.12.008

Ben-Ner, A., & Putterman, L. (2009). Trust, communication and contracts: An experiment. *Journal of Economic Behavior and Organization*, *70*(1–2), 106–121. http://doi.org/10.1016/j.jebo.2009.01.011

Bijman, J. (2008). *Contract farming in developing countries*. *An overview.* Working Paper. University of Wageningen. Retrieved from https://www.wur.nl/upload_mm/5/c/b/79333121-6f4b-4f86-9e8e-0a1782e784d6_ReviewContractFarming.pdf

Boonstra, W. J. (2016). Conceptualizing power to study social-ecological interactions. *Ecology and Society*, *21*(1). http://doi.org/10.5751/ES-07966-210121

Brandt, P., Ernst, A., Gralla, F., Luederitz, C., Lang, D. J., Newig, J., D. J. Abson ,Von Wehrden, H. (2013). A review of transdisciplinary research in sustainability science. *Ecological Economics*, *92*, 1–15. http://doi.org/10.1016/j.ecolecon.2013.04.008

Brown, M. L. (2007). Madagascar's Cyclone Vulnerability and the Global Vanilla Economy.

In E. C. Ones & A. D. Murphy (Eds.), *The political economy of hazards and disasters* (pp. 241–265). Plymouth, United Kingdom: AltaMira Press.

Brown, S. L., Manning, W. D., & Stykes, J. B. (2015). Family Structure and Child Well-Being: Integrating Family Complexity. *Journal of Marriage and the Family*, *77*(1), 177–190. http://doi.org/10.1111/jomf.12145

Cadot, O., Dutoit, L., & de Melo, J. (2008). The elimination of Madagascar's Vanilla Marketing Board, 10 years on. *Journal of African Economies*, *18*(3), 388–430. http://doi.org/10.1093/jae/ejn025

CNV International & Fairfood International. (2018). *Bittersweet Vanilla The unsavoury story of vanilla farmers in Madagascar's Sava Region*. Retrieved from https://www.cnvinternationaal.nl/_Resources/Persistent/9da3661792b3b40f13e64b21aa87894acd03e051/CNV Fairfood Vanilla-report ENG final.pdf

Coles, C., & Mitchell, J. (2011). *Markets and Rural Poverty: Upgrading in Value Chains*. (C. Coles & J. Mitchell, Eds.)*:* London: Earthscan, IDRC. http://doi.org/10.4324/9781315067230

Correll, D. S. (1953). Vanilla-its botany, history, cultivation and economic import. *Economic Botany*, *7*(4), 291–358. http://doi.org/10.1007/BF02930810

Coudouel, A., Hentschel, J. S., & Wodon, Q. T. (2002). Poverty Measurement and Analysis. In J. Klugmann. (Ed.) *A Sourcebook for Poverty Reduction Strategies* (pp. 27–74). Washington D.C.: World Bank Group Publications. Retrieved from https://siteresources.worldbank.org/INTPRS1/Resources/383606-1205334112622/5467_chap1.pdf

Danthu, P., Penot, E., Ranoarisoa, K. M., Rakotondravelo, J. C., Michel, I., Tiollier, M., Jahiel, M. (2014). The clove tree of Madagascar: A success story with an unpredictable future. *Bois et Forets Des Tropiques*, *68*(320), 83–96. Retrieved from http://publications.cirad.fr/une_notice.php?dk=574435

de Sherbinin, A., VanWey, L. K., McSweeney, K., Aggarwal, R., Barbieri, A., Henry, S., … Walker, R. (2008). Rural household demographics, livelihoods and the environment. *Global Environmental Change*, *18*(1), 38–53. http://doi.org/10.1016/j.gloenvcha.2007.05.005

Deininger, K., Carletto, C., Savastano, S., & Muwonge, J. (2012). Can diaries help in improving agricultural production statistics? Evidence from Uganda. *Journal of Development Economics*, *98*(1), 42–50. http://doi.org/10.1016/j.jdeveco.2011.05.007

Donovan, J., Cunha, M., Franzel, S., Gyau, A., & Mithöfer, D. (2013). *Guides for value chain* *development: A comparative review*. Wageningen: Technical Centre for Agricultural and Rural Cooperation (CTA). Retrieved from https://publications.cta.int/media/publications/downloads/1746_PDF.pdf

DRAE. (2018). Database of vanilla prices between 1960-2017 in the SAVA Region. Sambava: Direction Régional de l´Agriculture et Élevage.

Enfors, E. I., & Gordon, L. J. (2007). Analysing resilience in dryland agro-ecosystems: A case study of the Makanya catchment in Tanzania over the past 50 years. *Land Degradation & Development*, *18*(6), 680–696. http://doi.org/10.1002/ldr.807

ENSOMD. (2013). *Enquête nationale sur le suivi des Objectifs du Millénaire pour le Développement à Madagascar. Objectif 05= Améliorer la santé maternelle*. Antananarivo : Institut National de la Statistique. Retrieved from http://www.undp.org/content/dam/madagascar/docs/rapportsUNDP_MDG/doc_OMD/OMD_5_mg_2013.pdf

European Commission of Agriculture. (2018). EU Organic Label. Retrieved June 14, 2018, from https://ec.europa.eu/agriculture/organic/organic-farming/what-is-organic-farming_en

Fair Trade International. (2018). Fairtrade Standard for Small Producer Organizations & Fair Trade Standard for Contract Production. Retrieved June 14, 2018, from https://www.fairtrade.net/standards/

Fairfood International. (2014). *Recipe for change, The Need for Improved Livelihoods of Vanilla Farmers in Madagascar*. Amsterdam: Fairfoood International. Retrieved from http://international.fairfood.nl/wp-content/uploads/2015/02/Recipe-for-change.pdf

FAO. (2010). *Women in agriculture. Closing the gender gap for development.* Rome: Food and Agriculture Organisation of the United Nations. O Retrieved from http://www.fao.org/docrep/013/i2050e/i2050e.pdf

FAOstat. (2018). *Madagascar Vanilla export 2007-2017*. Rome: Food and Agriculture Organisation of the United Nations. Retrieved from http://www.fao.org/faostat/en/?#data/QC

Ferraro, P. J. (2002). The local costs of establishing protected areas in low-income nations: Ranomafana National Park, Madagascar. *Ecological Economics*, *43*, 261–275. http://doi.org/10.1016/S0921-8009(02)00219-7

Fisher, R. A. (1956). Statistical methods for research workers. *Quarterly Journal of the Royal Meteorological Society*, *82*(351), 119–119. http://doi.org/10.1002/qj.49708235130

Ganzhorn, J. U., Lowry, P. P., Schatz, G. E., & Sommer, S. (2001). The biodiversity of

Madagascar: one of the world's hottest hotspots on its way out. *Oryx*, *35*(4), 346–348. http://doi.org/10.1046/j.1365-3008.2001.00201.x

Gardner, C. J., Nicoll, M. E., Birkinshaw, C., Harris, A., Lewis, R. E., Rakotomalala, D., & Ratsifandrihamanana, A. N. (2018). The rapid expansion of Madagascar's protected area system. *Biological Conservation*, *220*, 29–36. http://doi.org/10.1016/j.biocon.2018.02.011

Genicot, G. (2002). Bonded labor and serfdom: A paradox of voluntary choice. *Journal of Development Economics*, *67*, 101–127. http://doi.org/10.1016/S0304-3878(01)00179-1

Ghadim, A. K. A., Pannell, D. J., & Burton, M. P. (2005). Risk, uncertainty, and learning in adoption of a crop innovation. *Agricultural Economics*, *33*(1), 1–9. http://doi.org/10.1111/j.1574-0862.2005.00433.x

Giovannucci, D., & Ponte, S. (2005). Standards as a new form of social contract? Sustainability initiatives in the coffee industry. *Food Policy*, *30*(3), 284–301. http://doi.org/10.1016/j.foodpol.2005.05.007

GIZ. (2013). *Gender and Rural Development: Aspects, Approaches and Good Practices*. Bonn: Gesellschaft für Internationale Zusammenarbeit. Retrieved from https://www.giz.de/fachexpertise/downloads/giz2013-en-gender-and-rural-development.pdf

Grubbs, F. E. (1950). Sample Criteria for Testing Outlying Observations. *The Annals of Mathematical Statistics*, *21*(1), 27–58. http://doi.org/10.1214/aoms/1177729885

Hänke, H., & Barkmann, J. (2017). Insurance Function of Livestock : Farmer ' s Coping Capacity with Crop Failure in South-Western Madagascar. *World Development*, *96*, 264–275. http://doi.org/10.1016/j.worlddev.2017.03.011

Hänke, H., Barkmann, J., Coral, C., Enfors Kautsky, E., & Marggraf, R. (2017). Social-ecological traps prevent rural development in southwestern Madagascar. *Ecology And Society*, *22*(1). https://doi.org/10.5751/ES-09130-220142

Havkin-Frenkel, D., & Frenkel, C. (2006). Postharvest handling and storage of cured vanilla beans. *Stewart Postharvest Review*, *4*(6), 1–9. http://doi.org/10.2212/spr.2006.4.6

Havnevik, K., Bryceson, D., Birgegård, L.-E., Matondi, P., & Beyene, A. (2007). *African Agriculture and the World Bank: Development or Impoverishment? Policy dialogue NO. 1*. University of Uppsala. Retrieved from http://nai.uu.se/research/publications/electronic_publ/dialogue_havnevik.pdf

Henson, S. and Jaffee, S. (2004). *Standards and Agro-Food Exports from Developing Countries: Rebalancing the Debate* (No. 3348). Washington D.C.: World Bank.

Retrieved from http://elibrary.worldbank.org/doi/pdf/10.1596/1813-9450-3348

Hending, D., A. Andrianiaina, Z. Rakotomalala, and S. Cotton. 2018. The Use of Vanilla Plantations by Lemurs: Encouraging Findings for both Lemur Conservation and Sustainable Agroforestry in the Sava Region, Northeast Madagascar. *International Journal of Primatology*:1–13. https://doi.org/10.1007/s10764-018-0022-1

Herimanga, N. (2016). *Stratégies des producteurs de vanille de la région Sava*. Master Thesis. University of Antananarivo.

Hirsch Hadorn, G., Biber-Klemm, S., Grossenbacher-Mansuy, W., Hoffmann-Riem, H., Joye, D., Pohl, C., Zemp, E. (2008). *The Emergence of Transdisciplinarity as a Form of Research*. (G. Hirsch Hadorn, C. Pohl, H. Hoffmann-Riem, S. Biber-Klemm, U. Wiesmann, W. Grossenbacher-Mansuy, D. Joye, Eds.) *Handbook of Transdisciplinary Research*. Bern: Springer. http://doi.org/10.1007/978-1-4020-6699-3

ILO. (2011). *Etat des lieux du travail des enfants dans la fillière vanille dans la région de la SAVA*. Antananarivo: International Labour Organisation of the United Nations. Retrieved from http://www.ilo.org/wcmsp5/groups/public/---africa/---ro-addis_ababa/---ilo-antananarivo/documents/publication/wcms_520913.pdf

INSTAT. (2011). *Enquête periodique auprès des menages. 2010.* Antananarivo : Institut National de la Statistique. Retrieved from http://instat.mg/essai/wp-content/uploads/2010/01/epm_10.pdf

INSTAT. (2013). *Enquête nationale sur le suivi des objectifs du millénaire pour le développement à Madagascar. 2012-2013 Étude Nationale. Objectif 2: Assurer l ' éducation primaire pour tous.* Antananarivo: Institut National de la Statistique. Retrieved from http://madagascar.unfpa.org/fr/publications/enquête-nationale-sur-le-suivi-des-objectifs-du-millénaire-pour-le-développement-à

INSTAT, World Bank, & Care International. (2003). Cartographie de la pauvreté à Madagascar. *Développement économique, service sociaux et pauvreté à Madagascar*. Antananarivo: Institut National de la Statistique, Worldbank & Care International.

IMF. (2015). *IMF Country Report No. 15/25 Republic of Madagascar*. Washington D.C.: International Monetary Fund. Retrieved from https://www.imf.org/~/media/Websites/IMF/imported-full-text-pdf/external/pubs/ft/scr/2015/_cr1525.ashx

Jarosz, L. (1993). Defining and explaining tropical deforestation: shifting cultivation and population growth in colonial Madagascar (1896-1940). *Economic Geography*, *69*(4), 366–379. http://doi.org/10.2307/143595

Johnson, N. D., & Mislin, A. A. (2011). Trust games: A meta-analysis. *Journal of Economic Psychology*, *32*(5), 865–889. http://doi.org/10.1016/j.joep.2011.05.007

Key, N., & Runsten, D. (1999). Contract farming, smallholders, and rural development in Latin America: The organization of agroprocessing firms and the scale of outgrower production. *World Development*, *27*(2), 381–401. http://doi.org/10.1016/S0305-750X(98)00144-2

Klein, J., Réau, B., & Edwards, M. (2008). Zebu landscapes: Conservation and cattle in Madagascar. In J. C. Kaufmann (Ed.), *Greening the Great Red Island : Madagascar in nature and culture* (pp. 157–178). Pretoria: Africa Institute of South Africa.

Kull, C. A. (2000). Deforestation, Erosion, and Fire : Degradation Myths in the Environmental History of Madagascar. *Environmental History*, *6*(4), 423–450. http://www.jstor.org/stable/20723156.

Kunz, S. (2018). Beitrag der Tierhaltung zur Diversifizierung des Einkommens der ländlichen Bevölkerung in der SAVA-Region Madagaskars. Master Thesis. University of Witzenhausen/Kassel.

Laney, R., & Turner, B. L. (2015). The persistence of self-provisioning among smallholder farmers in northeast Madagascar. *Human Ecology*, *43*(6), 811–826. http://doi.org/10.1007/s10745-015-9791-8

Levene, H. (1960). Levene test for equality of variances. In I. Olkin (Ed.), *Contributions to Probability and Statistics* (pp. 278-292). Stanford: Standford University Press.

Little, P. D., & Watts, M. J. (1994). *Living Under Contract: Contract Farming and Agrarian Transformation in Sub-Saharan Africa*. (P. D. Little & M. J. Watts, Eds.). Wisconsin: University of Wisconsin.

MAEP. (2003). *Monographie de la Region du Sava*. Antananarivo: Ministère de l'Agriculture, de l'Élevage et de la Peche.

Meuser, M., & Nagel, U. (2002). ExpertInneninterview - vielfach erprobt, wenig bedacht Ein Beitrag zur qualitativen Methodendiskussion. In A. Bogner, B. Littig, & W. Menz (Eds.), *Das Experteninterview Theorie, Methode, Anwendung.* (pp. 71–93). Wiesbaden: Springer. http://doi.org/10.1007/978-3-322-93270-9

Minten, B., & Barrett, C. B. (2008). Agricultural Technology, Productivity, and Poverty in Madagascar. *World Development*, *36*(5), 797–822. http://doi.org/10.1016/j.worlddev.2007.05.004

Minten, B., Randrianarison, L., & Swinnen, J. F. M. (2009). Global Retail Chains and Poor Farmers: Evidence from Madagascar. *World Development*, *37*(11), 1728–1741.

http://doi.org/10.1016/j.worlddev.2008.08.024

Mitchel, J., & Coles, C. (2011). *Markets and rural poverty: upgrading in value chains*. (J. Mitchel & C. Coles, Eds.). Ottawa: Earthscan, IDRC.

Moncrieffe, J. M. (2004). *Power Relations, Inequality And Poverty.* London: Overseas Development Institute and World Bank. Retrieved from http://siteresources.worldbank.org/INTEMPOWERMENT/Resources/486312-1096557889116/PowerFinalDraft2.doc

Morash, M. (2006). Gender-Related Victimization. In M. Morash (Ed.), *Understanding Gender, Crime, and Justice* (pp. 69–104). Thousand Oaks: SAGE Publications, Inc. http://doi.org/10.4135/9781452232126

Morriss, P. (2003). Power: A Philosophical Analysis. *Contemporary Political Theory,*2 (3), 355–357. http://doi.org/10.1057/palgrave.cpt.9300080

Moser, C. (2008). An economic analysis of deforestation in Madagascar in the 1990s. *Environmental Sciences*, *5*(2), 91–108. http://doi.org/10.1080/15693430801912170

Moser, C. M., & Barrett, C. B. (2003). The disappointing adoption dynamics of a yield-increasing, low external-input technology: the case of SRI in Madagascar. *Agricultural Systems*, *76*(3), 1085–1100. http://doi.org/10.1016/S0308-521X(02)00041-0

Myers, N., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A. B., & Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature*, *403*(6772), 853–8. http://doi.org/10.1038/35002501

Narayanan, S. (2014). Profits from participation in high value agriculture: Evidence of heterogeneous benefits in contract farming schemes in Southern India. *Food Policy*, *44*, 142–157. http://doi.org/10.1016/j.foodpol.2013.10.010

Neudert, R., Goetter, J. F., Andriamparany, J. N., & Rakotoarisoa, M. (2015). Income diversification, wealth, education and well-being in rural south-western Madagascar: Results from the Mahafaly region. *Development Southern Africa*, *32*(6), 1–27. http://doi.org/10.1080/0376835X.2015.1063982

OEC. (2017). *Madagascar Trade Summary*. London: Observatory of Economic Complexity. Retrieved from https://atlas.media.mit.edu/en/profile/country/mdg/#Exports

Oya, C. (2012). Contract farming in Sub-Saharan Africa: A survey of approaches, debates and issues. *Journal of Agrarian Change*, *12*, 1–33. http://doi.org/10.1111/j.1471-0366.2011.00337.x

Packer, E. (2008). The Flavor of Money: The Vanilla Industry and the Economy of Antalaha. *Independent Study Project (ISP) Collection. 571*. Los Angeles: University of California.

Retrieved from http://digitalcollections.sit.edu/isp_collection/571

PASEC. (2017). *Performances du système éducatif malgache : Compétences et facteurs de réussite au primaire*. PASEC, CONFEMEN, Dakar. Retrieved from http://www.pasec.confemen.org/wp-content/uploads/2017/05/Rapport-Madagascar.pdf

Patel, E. R. (2007). Logging of Rare Rosewood and Palisandre (Dalbergia spp.) within Marojejy National Park, Madagascar. *Madagascar Conservation & Development*, *2*(1), 11–16. http://doi.org/10.4314/mcd.v2i1.44124

Pierce Colfer, C. J., M. Elias, and B. S. Basnett. 2016. *Gender and Forests.Climate Change, Tenure, Value Chains and Emerging Issues.* New York: Routledge. Retrieved from: http://www.cifor.org/publications/pdf_files/Books/BColfer1701.pdf

Pingali, P. (2007). Agricultural growth and economic development: A view through the globalization lens. *Agricultural Economics*, *37*, 1–12. https://doi.org/10.1111/j.1574-0862.2007.00231.x

Poudyal, M., Jones, J. P. G., Rakotonarivo, O. S., Hockley, N., Gibbons, J. M., Mandimbiniaina, R., Ramamonjisoa, B. S. (2018). Who bears the cost of forest conservation? *PeerJ*, *6*, e5106. http://doi.org/10.7717/peerj.5106

Probst, P., Proietti, C., Annunziato, A., Paris, S.., & A., Wania (2017). *Tropical Cyclone ENAWO Post-Event Report*. Ispra: European Commission. Retrieved from http://publications.jrc.ec.europa.eu/repository/bitstream/JRC108086/2017_tc_enawo.pdf

Rader, N. (2017). Fear of Crime. In *Oxford Research Encyclopedia of Criminology* (p. 22). Oxford University Press. http://doi.org/10.1093/acrefore/9780190264079.013.10

Ragasa, C., Lambrecht, I., & Kufoalor, D. S. (2018). Limitations of Contract Farming as a Pro-poor Strategy: The Case of Maize Outgrower Schemes in Upper West Ghana. *World Development*, *102*, 30–56. http://doi.org/10.1016/j.worlddev.2017.09.008

Rainforest Alliance. (2018). Rainforest Alliance for Business: How certification works. Retrieved June 14, 2018, from https://www.rainforest-alliance.org/business/sas/how-certification-works/farm-certification/

Randriamamonjy, T. A., Gusti, I., Ketut, A., Handayani, R., & Setyono, P. (2016). Inefficiency of Forestry Regulations and Management Applicability on Rosewood (Dalbergia. Spp) Exploitation in Madagascar: Case Study of Marojejy and Masoala National Parks. *Researchers World*, *7*(3), 41–47. http://dx.doi.org/10.18843/rwjasc/v7i3/05

Ravallion, M. (1994). *Poverty Comparisons*. London: Routledge.

Sambuo, D. (2014). Tobacco Contract Farming Participation and Income in Urambo ;

Heckman ' s Selection Model. *Journal for Economics and Sustainable Development*, *5*(28), 230–238. Retrieved from https://www.iiste.org/Journals/index.php/JEDS/article/view/18840/19136

Scales, I. R. (2014). The future of conservation and development in Madagascar : time for a new paradigm ? *Madagascar Conservation and Development*, *9*(1), 5–12. http://doi.org/10.4314/mcd.v9i1.2

Scambor, E., & Struve, O. (2016). Diversity / Intersectionality - What Makes the Difference? Retrieved July 22, 2018, from http://www.peerthink.eu/peerthink/content/view/25/39/lang,en/

Sen, A. (1999). Development as Freedom. In A. Sen (Ed.), *Development as Freedom* (pp. 35–53). Oxford: Oxford University Press.

Shackleton, S., Paumgarten, F., Kassa, H., Husselman, M., & Zida, M. (2011). Opportunities for enhancing poor women's socioeconomic empowerment in the value chains of three African non-timber forest products (NTFPs). *International Forestry Review*, *13*(2), 136–151. http://doi.org/10.1505/146554811797406642

Shapiro, S. S., & Wilk, M. B. (1965). An Analysis of Variance Test for Normality (Complete Samples). *Biometrika*, *52*(3/4), 591. http://doi.org/10.2307/2333709

Sheskin, D. J. (2004). *Handbook of parametric and nonparametric statistical procedures* (3rd ed.). Boca Raton: Chapmann & Hall/CRC.http://doi.org/10.1198/tech.2004.s209

Sielaff, S., Witter, C., & Tenge, C. (2014). Symrise and Vanilla: Tradition, Strategy, and Total Commitment. In M. D'heur (Ed.), *Sustainable Value Chain Management* (pp. 185–205). Heidelberg: Springer. http://doi.org/10.1007/978-3-319-12142-0

Simmons, P., Winters, P., & Patrick, I. (2005). An analysis of contract farming in East Java, Bali, and Lombok, Indonesia. *Agricultural Economics*, *33*(SUPPL. 3), 513–525. http://doi.org/10.1111/j.1574-0864.2005.00096.x

Steffan-Dewenter, I., M. Kessler, J. Barkmann, M. M. Bos, D. Buchori, S. Erasmi, H. Faust, G. Gerold, K. Glenk, S. R. Gradstein, E. Guhardja, M. Harteveld, D. Hertel, P. Höhn, M. Kappas, S. Köhler, C. Leuschner, M. Maertens, R. Marggraf, S. Migge-Kleian, J. Mogea, R. Pitopang, M. Schaefer, S. Schwarze, S. G. Sporn, A. Steingrebe, S. S. Tjitrosoedirdjo, S. Tjitrosoemito, A. Twele, R. Weber, L. Woltmann, M. Zeller, and T. Tscharntke. 2007. Tradeoffs between income, biodiversity, and ecosystem functioning during tropical rainforest conversion and agroforestry intensification. *Proceedings of the National Academy of Sciences of the United States of America* 104(12):4973–8. https://doi.org/10.1073/pnas.0608409104

Stoop, W. A., Uphoff, N., & Kassam, A. (2002). A review of agricultural research issues raised by the system of rice intensification (SRI) from Madagascar: Opportunities for improving farming systems for resource-poor farmers. *Agricultural Systems*, *71*(3), 249–274. http://doi.org/10.1016/S0308-521X(01)00070-1

Styger, E., Rakotondramasy, H. M., Pfeffer, M. J., Fernandes, E. C. M., & Bates, D. M. (2007). Influence of slash-and-burn farming practices on fallow succession and land degradation in the rainforest region of Madagascar. *Agriculture, Ecosystems and Environment*, *119*(3–4), 257–269. http://doi.org/10.1016/j.agee.2006.07.012

Sunderlin, W. D., Belcher, B., Santoso, L., Angelsen, A., Burgers, P., Nasi, R., & Wunder, S. (2005). Livelihoods, forests, and conservation in developing countries: An overview. *World Development*, *33*(9), 1383–1402. http://doi.org/10.1016/j.worlddev.2004.10.004

Tilghman, L. M. (2014). *City livelihoods and village linkages: Rural-urban migrants in Tamatave, Madagascar*. Athens: University of Georgia. Retrieved from https://athenaeum.libs.uga.edu/handle/10724/30679

Timko, J., Waeber, P., & Kozak, R. (2010). The socio-economic contribution of non-timber forest products to rural livelihoods in Sub-Saharan Africa: knowledge gaps and new directions. *International Forestry Review*, *12*(3), 284–294. http://doi.org/10.1505/ifor.12.3.284

Ton, G., Vellema, W., Desiere, S., Weituschat, S., & D'Haese, M. (2018). Contract farming for improving smallholder incomes: What can we learn from effectiveness studies? *World Development*, *104*, 46–64. http://doi.org/10.1016/j.worlddev.2017.11.015

Trebbin, A. (2014). Linking small farmers to modern retail through producer organizations - Experiences with producer companies in India. *Food Policy*, *45*, 35–44. http://doi.org/10.1016/j.foodpol.2013.12.007

Trifkovic, N. (2014). Governance Strategies and Welfare Effects: Vertical Integration and Contracts in the Catfish Sector in Vietnam. *The Journal of Development Studies Governance Strategies and Welfare Effects*, (February 2015), 37–41. http://doi.org/10.1080/00220388.2014.903245

UNDESA. (2017). *Population Facts: Household size and composition around the world.* New York: United Nations Department of Economic and Social Affairs. Retrieved from http://www.un.org/en/development/desa/population/publications/pdf/popfacts/PopFacts_2017-2.pdf

UNDP. (2014). *The Millenium Development Goals Report 2014*. *The Millenium Development Goals Report 2014*. New York: United Nations Development Program. Retrieved from

http://www.un.org/millenniumgoals/reports.shtml
UNDP. (2018). Multidimensional Poverty Index (MPI). New York: United Nations Development Program Retrieved March 17, 2018, from http://hdr.undp.org/en/content/multidimensional-poverty-index-mpi
UNESCO. (2015). *Madagascar. Examen national 2015 de l'Éducation pour tous*. Paris: United Nations Educational, Scientific and Cultural Organization. Retrieved from http://unesdoc.unesco.org/images/0023/002317/231749f.pdf
UNESCO. (2017). *Global Education Monitoring Report. Accountability in Education: Meeting our Commitments*. Paris: United Nations Educational, Scientific and Cultural Organization. Retrieved from http://unesdoc.unesco.org/images/0025/002593/259338e.pdf
UNICEF. (2014). UNICEF Madagascar. Water, sanitation and hygiene. New York: United Nations International Children's Emergency Fund. Retrieved from https://www.unicef.org/madagascar/eng/wes_15164.html
UNICEF. (2018). Madagascar. Statistics. The Rate Of Progress. New York: United Nations International Children's Emergency Fund. Retrieved September 5, 2018, from https://www.unicef.org/infobycountry/madagascar_statistics.html#122
Vieilledent, G., Grinand, C., Rakotomalala, F. A., Ranaivosoa, R., Rakotoarijaona, J. R., Allnutt, T. F., & Achard, F. (2018). Combining global tree cover loss data with historical national forest cover maps to look at six decades of deforestation and forest fragmentation in Madagascar. *Biological Conservation*, *222*, 189–197. http://doi.org/10.1016/j.biocon.2018.04.008
Waeber, P. O., Wilm??, L., Mercier, J. R., Camara, C., & Lowry, P. P. (2016). How effective have thirty years of internationally driven conservation and development efforts been in Madagascar? *PLOS ONE*, *11*(8), e0161115. http://doi.org/10.1371/journal.pone.0161115
WFP. (2015). *Southern Africa Food & Nutrition Security Working Group.* Rome: World Food Program. Retrieved from http://documents.wfp.org/stellent/groups/public/documents/ena/wfp278172.pdf
WHO. (2014). *Madagascar. Sanitation, drinking-water and hygiene status overview.* Madagascar. Geneva: World Health Organization. Retrieved from http://www.who.int/water_sanitation_health/glaas/2014/madagascar-12-oct.pdf
Wilson, P. N. (2000). Social Capital, Trust, and the Agribusiness of Economics. *Journal of Agricultural and Resource Economics*, *25*(1), 1–13. Retrieved from http://www.jstor.org/stable/40987045

Wiseman, V., Conteh, L., & Matovu, F. (2005). Using diaries to collect data in resource-poor settings : questions on design and implementation. *Health Policy Plan*, *20*(6), 394–404. http://doi.org/10.1093/heapol/czi042

Wolgin, J. M. (1975). Resource Allocation and Risk: A Case Study of Smallholder Agriculture in Kenya. *American Journal of Agricultural Economics*, *57*(4), 622–630. http://doi.org/10.2307/1238880

World Bank. (2014). *Face of poverty in Madagascar: poverty, gender, and inequality assessment. Report No. 78131-MG*. Washington D.C.: World Bank. Retrieved from http://documents.worldbank.org/curated/en/2014/03/19548476/face-poverty-madagascar-poverty-gender-inequality-assessment

World Bank. (2015a). *Madagascar Systematic Country Diagnostic*. Washington D.C.: World Bank. Retrieved from http://documents.worldbank.org/curated/en/743291468188936832/pdf/99197-CAS-P151721-IDA-SecM2015-0168-IFC-SAecM2015-0123-Box393189B-OUO-9.pdf

World Bank. (2015b). Madagascar population statistics database. Washington D.C.:World Bank. Retrieved December 15, 2015, from http://data.worldbank.org/indicator/SP.POP.GROW

World Bank. (2017). *Country partnership framework for the republic of Madagascar*. Washington D.C.: World Bank. Retrieved from https://openknowledge.worldbank.org/bitstream/handle/10986/27568/Madagascar-CPF-FinalBoardapprovalJune5-2017-06052017.pdf?sequence=1

World Bank. (2018). Access to electricity (% of population). Washington D.C.: World Bank. Retrieved September 5, 2018, from https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS

Wüstefeld, M. (2004). *Bedeutung der Rinder für die Ernährungssicherung im semiariden Süden Madagaskars*. Eschborn: Margraf Publisher.

Yuval-Davis, N. (2006). Intersectionality and Feminist Politics. *European Journal of Women's Studies*, *13*(3), 193–209. http://doi.org/10.1177/1350506806065752

Zaehringer, J., Eckert, S., & Messerli, P. (2015). Revealing Regional Deforestation Dynamics in North-Eastern Madagascar—Insights from Multi-Temporal Land Cover Change Analysis. *Land*, *4*(2), 454–474. http://doi.org/10.3390/land4020454

Zanoni, P., Janssens, M., Benschop, Y., & Nkomo, S. (2010). Unpacking diversity, grasping inequality: Rethinking difference through critical perspectives. *Organization*, *17*(1), 9–29. http://doi.org/10.1177/1350508409350344

Equation 1: Formula for calculating sampling weights

Sampling weights of the village strata were calculated through:

$W_i = [(n_i / N) / (s_i / S)]$, where:

n_i= is the number of HHs in strata i (absolute frequency in population)

N= is the total number of HHs in the sampling frame

s_i= is the size of the sample having elements belonging to strata i, (absolute frequency in stratified sample)

S= is the size of the sample

APPENDIX

Appendix 1: Description of the Work-packages

WP 1: Project Management, Coordination, Theoretical Advancement

WP1 ensures the inter and transdisciplinary perspective of the empirical research carried out by the project participants. This includes providing research infrastructure in the project area, coordinating local stakeholder inputs, organizing/facilitating joint research phases, promoting an inter- and transdisciplinary research design, unification and joint reflexion of the research process and empirical findings. In addition, WP1 has coordinated and conducted the present baseline survey and report but is also running a longitudinal study to complement the baseline survey.

Prof. Dr. Andrea D. Bührmann[1)], Dr. Yvonne Franke[1)], Prof. Dr. Rainer Marggraf[2)], Dr. Hendrik Hänke[2)]

[1)]Göttingen Diversity Research Institute, Faculty of Social Sciences University of Goettingen

[2)]Research Unit Environmental-and Resource Economics, Department of Agricultural Economics and Rural Development, University of Goettingen

WP 2: PhD program "Diversity Turn in Sustainability Science"

WP 2 is in charge for the PhD program "Diversity Turn in Sustainability Science" focusing on social diversity, sustainability, and transdisciplinary cooperation. The work package is organizing workshops for the PhD students in order to enable them to meet the challenges of transdisciplinary research in the field of social diversity and sustainability research. Thereby, it ensures the quality of the common research process.

Prof. Dr. Andrea D. Bührmann, Dr. Yvonne Franke

Göttingen Diversity Research Institute, Faculty of Social Sciences University of Goettingen

WP 3: Social Diversity and Power Relations

In addition to the environmental and economic dimensions of sustainability, the social dimension is equally important. However, in sustainability research this component is often neglected. In order to bridge this gap, WP3 investigates, whether, and to what extent does the introduction of the vertical integrated value chain system influence existing power relations between and among different categories of smallholder vanilla farmers at both household and community levels. By highlighting social diversity and power relations, we seek to understand the underlying processes by which individuals and group access privileges and/or disadvantages.

Prof. Dr. Andrea D. Bührmann[1)], Annette Witherspoon[1)], Raozivelo Ony Solomampionona[2)]

[1)] Göttingen Diversity Research Institute, Faculty of Social Sciences University of Goettingen

[2)] Department of Sociology, Faculty of Law, Economics, Management and Sociology (DEGS), University of Antananarivo

WP 4: Preferences for Contract Farming Arrangements, Economic and Institutional Restrictions in the Vanilla Value Chain

WP4 analyses economic and institutional restrictions in the vanilla value chain with a main focus on contract farming arrangements directly offered by international vanilla buyers as a means of vertical integration of smallholders. Intensive qualitative and semi-quantitative pre-studies investigated the role of vanilla theft, child labour, quality premiums, or of vanilla marketing regulations accounting in particular for CFAs in relation to Fair Trade, EU organics or the private Rainforest Alliance standard. On this basis, a choice experiment on the relative economic importance of CFA benefits and CFA restrictions was conducted.

The analysis of economic and institutional restrictions is carried out in collaboration with WPs 1 and 8-10 via the Diversity Turn Longitudinal Study (DTLS), a 1-year, high frequency sampling study using a subsample of the baseline study (DTBS). The DTLS mainly addresses a diversity-sensitive assessment of the opportunities of smallholder households to diversify income and livelihoods. The longitudinal study as well as diversity-related analysis of the baseline study is realised in close collaboration with WP1 and with the University of Antananarivo. Furthermore, WP4 collaborates with WP5 on the meaning of trust in the vanilla value chain and with WP6 on the influence of CFA benefits to schools and households on local schooling and on educational achievements.

Prof. Dr. Jan Barkmann[1), 2)], Lloyd Blum[1), 2)], Fanilo Andrianisaina[3)], Matteo Parisi[2)]

[1)] Faculty of Social Sciences, Risk- and Sustainability Sciences, University of Applied

Sciences of Darmstadt
[2] Faculty of Agricultural Sciences, Georg-August-Universität Göttingen
[3] Faculty of Agricultural Sciences, University of Antananarivo

WP 5: Trust and Markets

Africa is characterized for having very low trust levels (Johnson and Mislin 2011). Trust and social capital are necessary conditions, but not sufficient, for the establishment of strong and lasting business relations and long-term economic development. Yet, up to date, there are no trust measures in Madagascar. In this sense, having subjective (questionnaire) measures of these variables is ideal.

Trust can be defined as the expectation that one person will not take advantage but reciprocate a voluntary but risky decision of someone else (Johnson and Mislin 2011, Ben-Ner & Putterman 2009). It can be measured with the use of an investment game or with the question "Generally speaking, would you say that most people can be trusted or that you cannot be too careful in dealing with people?" which has been used in the World Values Survey (WVS).

In our work package, we study the dynamics of trust, what factors might destroy it and what factors might contribute to build it. In addition, we are interested in understanding the effects of this dynamic in the integration of small-scale farmers in international markets. Furthermore, we investigate the effects that lack of trust and crime have on the efficiency of vanilla production.

Prof. Dr. Marcela Ibañez Diaz, Viviana Uruena,
Research Centre "Poverty, Equity and Growth in Developing Countries", Faculty of Economics, University of Goettingen

WP 6: Competencies for rural Madagascar

WP 6 investigates the preconditions for the integration of locally relevant contents (i.e. vanilla production in the northeast of Madagascar) with respect to Education for Sustainable Development in primary education. Particularly, our analysis focuses on the contents of the current national curriculums of Malagasy primary schools and on the conceptual knowledge of primary school teachers regarding Sustainable Development Issues. The aim of the present research consists in obtaining additional knowledge of school education, teacher training and about potentials of designing local relevant curricula in the SAVA region. Furthermore, we will look for transferring our results on other regions showing similar conditions.

Prof. Dr. Susanne Bögeholz, Janna Niens

Albrecht-von Haller-Institute for Plant Science, Faculty for Biology and Psychology, University of Goettingen

WP 7: Animal Husbandry as a Means of Income Diversification

Many rural households in Madagascar keep livestock for food self-sufficiency, as insurance for unforeseen costs or calamities, or, in the case of cattle and oxen, to use their work force. Against this background, WP 7 compares the purposes of livestock keeping of households that are integrated in vanilla production with such families who operate outside the vanilla production. Besides, WP7 studies livestock husbandry practices, namely animal management, feeding, health care, and breeding strategies, along with changes in livestock numbers during the past decade, and the reasons for such practices and changes. The aim is to clarify whether differences in reasons for and practices of animal husbandry by the different types of vanilla-producing households are explained by their (non-)integration in the vanilla value chain, or rather by other factors. In collaboration with WP4 we also aim to determine possible effects of an expansion and / or intensification of livestock keeping on income diversification and household food security.

Prof. Dr. Eva Schlecht, Animal Husbandry in the Tropics and Subtropics, Faculty of Organic Agriculture, Georg-August- University and University of Kassel

WP 8: Biodiversity and Ecosystem Services of Agro-ecologically Optimized Land Use

With the majority of Madagascar´s population living on subsistence farming in rural areas, natural resources are under great pressure to sustain human livelihoods. The depletion and degradation of the natural environment is threatening biodiversity and associated ecosystem services resulting in decreased agricultural productivity. Vanilla plantations depending on shade and tutor trees can be planted in different settings ranging from intensively planted settings to forest-like plantations (Havkin-Frenkel & Belanger 2010). Vanilla cultivated as agroforestry system can function as valuable habitat for biodiversity (Hending et al. 2018). So far, no systematic research has been done on the ecological value of vanilla cultivation in the SAVA region. Hence, we argue that the value of vanilla farming for biodiversity conservation and ecosystem services deserves research attention.

In order to assess the value of vanilla farming for biodiversity conservation, we perform a biodiversity comparison of the prevalent land use systems in the SAVA region using specific species groups as indicators (butterflies, ants and herbaceous plants). In order to further understand the response of biodiversity to different land use change drivers we assess diverse functional traits for our species groups. For vanilla, our biodiversity data will be analysed across a canopy cover gradient and interlinked with vanilla yield data, vanilla health data and other ecological as well as socio-economic variables. Finally, we are aiming to achieve a better understanding of vanilla cultivation as well as how land use is forming biodiversity in order to provide recommendations reconciling biodiversity conservation and sustainable land use.

Prof. Dr. Teja Tscharntke[1)], Dr. Ingo Grass[1)], Annemarie Wurz[1)], Andry Ny Aina Rakotomalala[2)], Jeannie Marie Estelle Raveloaritiana[3)]

[1)]Faculty of Agricultural Sciences, Department of Crop Sciences, Agroecology
[2)]Department of Entomology, Faculty of Science, University of Antananarivo
[3)]Department of Plant Biology and Ecology University of Antananarivo

WP 9: Conservation of biological diversity

North-eastern Madagascar is one of the most biologically diverse regions of the world. So far, ecological research has focused on forests and protected areas while the human-dominated landscape outside the forests has been largely ignored. To change this, we investigate the landscape- to regional-scale impacts of different types of vanilla cultivation as well as alternative land-uses (e.g. swidden agriculture, rice) on the conservation of biodiversity using key indicator groups (birds, amphibians, reptiles).

The plot-based biodiversity data will then be analysed along a vanilla canopy cover gradient as well as comparatively among land uses. Given the heterogeneity of the landscape, we will supplement the plot-based analysis with novel modelling approaches of countryside biogeography to investigate the impact of the surrounding landscape on the local biodiversity. This will allow a detailed multi-scale evaluation of the biodiversity impacts of vanilla cultivation in NE Madagascar.

Prof. Dr. Holger Kreft[1)], Dominic Martin[1)], Thio Rosin Fulgence [2), 3)]

[1)]Biodiversity, Macroecology and Biogeography, Faculty of Forest Sciences and Forest Ecology, University of Goettingen
[2)] Department of Animal Biology, University of Antananarivo Department of Animal Biology, University of Antananarivo
[3)]Regional University Center of the SAVA region (CURSA)

WP 10: Trees in the vanilla production landscape

Trees in agroforestry systems such as the vanilla farming system provide multiple functions. These include direct and indirect contributions to biodiversity, the provisioning of products as well as soil and climate protection. Especially in Madagascar, the level of diversity and endemism among trees is extraordinarily high, yet, deforestation continues at unabated rates (Arruda-Ferreira 2018, Vieilledenta et al., 2018).

In WP 10, we study the diversity and use of trees as well as their functional role inside vanilla cultivation systems and in surrounding land-uses. In close collaboration with WP8 and WP9, we collect plot-based biodiversity data, to investigate the impacts of vanilla cultivation on biological diversity and assess the conservation value of this human-dominated landscape. From a structural and management point of view, trees appear in two categories in Malagasy vanilla agroforestry. There are small statured tutor trees carrying the vanilla plants; these trees are usually planted from cuttings, have stems up to 2.2 metres high and the canopy is frequently cut back. In the second tree category, the trees are bigger in diameter and higher. These trees are mostly evergreen and can be left-overs from an original forest, spontaneously established after forest logging, or be planted such as mango, jack fruit or clove. The shade trees are used for fruits, timber, charcoal, and firewood. There is a wide range of ‘shade’ tree density and tree canopy cover in the Malagasy vanilla cultivation (Arruda-Ferreira 2018). Jointly and interactively, we want to assess the ecological, economic and socio-cultural factors that are linked with tree cultivation. With this, we wish to contribute to develop land use diversification strategies by improving the integration of native trees in land use systems.

Prof. Dr. Dirk Hölscher[1)], Kristina Osen[1)], Marie Rolande Soazafy[2)]

[1)] Tropical Silviculture and Forest Ecology, Faculty of Forest Sciences and Forest Ecology, University of Goettingen

[2)] Doctoral School on Natural Ecosystems (EDEN) of the University of Mahajanga

[3)] Regional University Center of the SAVA region (CURSA)

Appendix 2: Sampling weights for villages where vertical integration of vanilla was ex-ante absent

Village cluster	Inhabitants	Absolute frequency (%)	Relative frequency (%)	Absolute frequency in random sample	Relative frequency in random sample%	Sampling weight for regional extrapolation
1	0 - <1000	101	46.76	6	20	2.338
2	>1000 - <2000	62	28.70	6	20	1.435
3	>2000 - <3000	35	16.20	6	20	0.810
4	>3000 - <4000	12	5.56	6	20	0.278
5	>4000	6	2.78	6	20	0.139
	All	**216**	**100**	**30**	**100**	

Appendix 3: Sampling weights for villages where vertical integration of vanilla famers was found

Village cluster	Inhabitants	Absolute frequency (%)	Relative frequency (%)	Absolute frequency in random sample	Relative frequency in random sample%	Sampling weight for regional extrapolation
1	0 - <1000	38	32.48	6	20	1.624
2	>1000 - <2000	36	30.77	6	20	1.538
3	>2000 - <3000	19	16.24	6	20	0.812
4	>3000 - <4000	14	11.97	6	20	0.598
5	>4000	10	8.55	6	20	0.427
	All	**117**	**100**	**30**	**100**	

Appendix 4: Summary of outlier removal

https://www.uni-goettingen.de/de/document/download/b86ed3eabde6da2b61e1b6ec19cfe643.pdf/Appendix_4_Outlier_Removal.pdf

Appendix 5: DTBS questionnaire

https://www.uni-goettingen.de/de/document/download/958f609873932fc51bb7d83e7a1073dd.pdf/Appendix_5_DTBS_Survey_Questionnaire.pdf

Appendix 6: List of Discussion Paper Series by the Department of Agricultural Economics and Rural Development, University of Goettingen

Georg-August-Universität Göttingen
Department für Agrarökonomie und Rurale Entwicklung

Diskussionspapiere

2000 bis 31. Mai 2006

Institut für Agrarökonomie

Georg-August-Universität, Göttingen

2000		
0001	Brandes, W.	Über Selbstorganisation in Planspielen: ein Erfahrungsbericht, 2000
0002	von Cramon-Taubadel, S. u. J. Meyer	Asymmetric Price Transmission: Factor Artefact?, 2000
2001		
0101	Leserer, M.	Zur Stochastik sequentieller Entscheidungen, 2001
0102	Molua, E.	The Economic Impacts of Global Climate Change on African Agriculture, 2001
0103	Birner, R. et al.	‚Ich kaufe, also will ich?': eine interdisziplinäre Analyse der Entscheidung für oder gegen den Kauf besonders tier- u. umweltfreundlich erzeugter Lebensmittel, 2001
0104	Wilkens, I.	Wertschöpfung von Großschutzgebieten: Befragung von Besuchern des Nationalparks Unteres Odertal als Baustein einer Kosten-Nutzen-Analyse, 2001
2002		
0201	Grethe, H.	Optionen für die Verlagerung von Haushaltsmitteln aus der ersten in die zweite Säule der EU-Agrarpolitik, 2002
0202	Spiller, A. u. M. Schramm	Farm Audit als Element des Midterm-Review : zugleich ein Beitrag zur Ökonomie von Qualitätsicherungssytemen, 2002
2003		
0301	Lüth, M. et al.	Qualitätssignaling in der Gastronomie, 2003

0302	Jahn, G., M. Peupert u. A. Spiller	Einstellungen deutscher Landwirte zum QS-System: Ergebnisse einer ersten Sondierungsstudie, 2003
0303	Theuvsen, L.	Kooperationen in der Landwirtschaft: Formen, Wirkungen und aktuelle Bedeutung, 2003
0304	Jahn, G.	Zur Glaubwürdigkeit von Zertifizierungssystemen: eine ökonomische Analyse der Kontrollvalidität, 2003
		2004
0401	Meyer, J. u. S. von Cramon-Taubadel	Asymmetric Price Transmission: a Survey, 2004
0402	Barkmann, J. u. R. Marggraf	The Long-Term Protection of Biological Diversity: Lessons from Market Ethics, 2004
0403	Bahrs, E.	VAT as an Impediment to Implementing Efficient Agricultural Marketing Structures in Transition Countries, 2004
0404	Spiller, A., T. Staack u. A. Zühlsdorf	Absatzwege für landwirtschaftliche Spezialitäten: Potenziale des Mehrkanalvertriebs, 2004
0405	Spiller, A. u. T. Staack	Brand Orientation in der deutschen Ernährungswirtschaft: Ergebnisse einer explorativen Online-Befragung, 2004
0406	Gerlach, S. u. B. Köhler	Supplier Relationship Management im Agribusiness: ein Konzept zur Messung der Geschäftsbeziehungsqualität, 2004
0407	Inderhees, P. et al.	Determinanten der Kundenzufriedenheit im Fleischerfachhandel
0408	Lüth, M. et al.	Köche als Kunden: Direktvermarktung landwirtschaftlicher Spezialitäten an die Gastronomie, 2004
		2005
0501	Spiller, A., J. Engelken u. S. Gerlach	Zur Zukunft des Bio-Fachhandels: eine Befragung von Bio-Intensivkäufern, 2005
0502	Groth, M.	Verpackungsabgaben und Verpackungslizenzen als Alternative für ökologisch nachteilige Einweggetränkeverpackungen? Eine umweltökonomische Diskussion, 2005
0503	Freese, J. u. H. Steinmann	Ergebnisse des Projektes ‘Randstreifen als Strukturelemente in der intensiv genutzten

		Agrarlandschaft Wolfenbüttels', Nichtteilnehmerbefragung NAU 2003, 2005
0504	Jahn, G., M. Schramm u. A. Spiller	Institutional Change in Quality Assurance: the Case of Organic Farming in Germany, 2005
0505	Gerlach, S., R. Kennerknecht u. A. Spiller	Die Zukunft des Großhandels in der Bio-Wertschöpfungskette, 2005
	2006	
0601	Heß, S., H. Bergmann u. L. Sudmann	Die Förderung alternativer Energien: eine kritische Bestandsaufnahme, 2006
0602	Gerlach, S. u. A. Spiller	Anwohnerkonflikte bei landwirtschaftlichen Stallbauten: Hintergründe und Einflussfaktoren; Ergebnisse einer empirischen Analyse, 2006
0603	Glenk, K.	Design and Application of Choice Experiment Surveys in So-Called Developing Countries: Issues and Challenges,
0604	Bolten, J., R. Kennerknecht u. A. Spiller	Erfolgsfaktoren im Naturkostfachhandel: Ergebnisse einer empirischen Analyse, 2006 (entfällt)
0605	Hasan, Y.	Einkaufsverhalten und Kundengruppen bei Direktvermarktern in Deutschland: Ergebnisse einer empirischen Analyse, 2006
0606	Lülfs, F. u. A. Spiller	Kunden(un-)zufriedenheit in der Schulverpflegung: Ergebnisse einer vergleichenden Schulbefragung, 2006
0607	Schulze, H., F. Albersmeier u. A. Spiller	Risikoorientierte Prüfung in Zertifizierungssystemen der Land- und Ernährungswirtschaft, 2006
	2007	
0701	Buchs, A. K. u. J. Jasper	For whose Benefit? Benefit-Sharing within Contractural ABC-Agreements from an Economic Prespective: the Example of Pharmaceutical Bioprospection, 2007
0702	Böhm, J. et al.	Preis-Qualitäts-Relationen im Lebensmittelmarkt: eine Analyse auf Basis der Testergebnisse Stiftung Warentest, 2007
0703	Hurlin, J. u. H. Schulze	Möglichkeiten und Grenzen der Qualitäts-sicherung in der Wildfleischvermarktung, 2007
Ab Heft 4, 2007:		**Diskussionspapiere (Discussion Papers), Department für Agrarökonomie und Rurale Entwicklung Georg-August-Universität, Göttingen (ISSN 1865-2697)**

0704	Stockebrand, N. u. A. Spiller	Agrarstudium in Göttingen: Fakultätsimage und Studienwahlentscheidungen; Erstsemesterbefragung im WS 2006/2007
0705	Bahrs, E., J.-H. Held u. J. Thiering	Auswirkungen der Bioenergieproduktion auf die Agrarpolitik sowie auf Anreizstrukturen in der Landwirtschaft: eine partielle Analyse bedeutender Fragestellungen anhand der Beispielregion Niedersachsen
0706	Yan, J., J. Barkmann u. R. Marggraf	Chinese tourist preferences for nature based destinations – a choice experiment analysis
	2008	
0801	Joswig, A. u. A. Zühlsdorf	Marketing für Reformhäuser: Senioren als Zielgruppe
0802	Schulze, H. u. A. Spiller	Qualitätssicherungssysteme in der europäischen Agri-Food Chain: Ein Rückblick auf das letzte Jahrzehnt
0803	Gille, C. u. A. Spiller	Kundenzufriedenheit in der Pensionspferdehaltung: eine empirische Studie
0804	Voss, J. u. A. Spiller	Die Wahl des richtigen Vertriebswegs in den Vorleistungsindustrien der Landwirtschaft – Konzeptionelle Überlegungen und empirische Ergebnisse
0805	Gille, C. u. A. Spiller	Agrarstudium in Göttingen. Erstsemester- und Studienverlaufsbefragung im WS 2007/2008
0806	Schulze, B., C. Wocken u. A. Spiller	(Dis)loyalty in the German dairy industry. A supplier relationship management view Empirical evidence and management implications
0807	Brümmer, B., U. Köster u. J.-P. Loy	Tendenzen auf dem Weltgetreidemarkt: Anhaltender Boom oder kurzfristige Spekulationsblase?
0808	Schlecht, S., F. Albersmeier u. A. Spiller	Konflikte bei landwirtschaftlichen Stallbauprojekten: Eine empirische Untersuchung zum Bedrohungspotential kritischer Stakeholder
0809	Lülfs-Baden, F. u. A. Spiller	Steuerungsmechanismen im deutschen Schulverpflegungsmarkt: eine institutionenökonomische Analyse
0810	Deimel, M., L. Theuvsen u. C. Ebbeskotte	Von der Wertschöpfungskette zum Netzwerk: Methodische Ansätze zur Analyse des Verbundsystems der Veredelungswirtschaft Nordwestdeutschlands
0811	Albersmeier, F. u. A. Spiller	Supply Chain Reputation in der Fleischwirtschaft
	2009	

0901	Bahlmann, J., A. Spiller u. C.-H. Plumeyer	Status quo und Akzeptanz von Internet-basierten Informationssystemen: Ergebnisse einer empirischen Analyse in der deutschen Veredelungswirtschaft
0902	Gille, C. u. A. Spiller	Agrarstudium in Göttingen. Eine vergleichende Untersuchung der Erstsemester der Jahre 2006-2009
0903	Gawron, J.-C. u. L. Theuvsen	„Zertifizierungssysteme des Agribusiness im interkulturellen Kontext – Forschungsstand und Darstellung der kulturellen Unterschiede"
0904	Raupach, K. u. R. Marggraf	Verbraucherschutz vor dem Schimmelpilzgift Deoxynivalenol in Getreideprodukten Aktuelle Situation und Verbesserungsmöglichkeiten
0905	Busch, A. u. R. Marggraf	Analyse der deutschen globalen Waldpolitik im Kontext der Klimarahmenkonvention und des Übereinkommens über die Biologische Vielfalt
0906	Zschache, U., S. von Cramon-Taubadel u. L. Theuvsen	Die öffentliche Auseinandersetzung über Bioenergie in den Massenmedien - Diskursanalytische Grundlagen und erste Ergebnisse
0907	Onumah, E. E.,G. Hoerstgen-Schwark u. B. Brümmer	Productivity of hired and family labour and determinants of technical inefficiency in Ghana's fish farms
0908	Onumah, E. E., S. Wessels, N. Wildenhayn, G. Hoerstgen-Schwark u. B. Brümmer	Effects of stocking density and photoperiod manipulation in relation to estradiol profile to enhance spawning activity in female Nile tilapia
0909	Steffen, N., S. Schlecht u. A. Spiller	Ausgestaltung von Milchlieferverträgen nach der Quote
0910	Steffen, N., S. Schlecht u. A. Spiller	Das Preisfindungssystem von Genossenschaftsmolkereien
0911	Granoszewski, K.,C. Reise, A. Spiller u. O. Mußhoff	Entscheidungsverhalten landwirtschaftlicher Betriebsleiter bei Bioenergie-Investitionen - Erste Ergebnisse einer empirischen Untersuchung -
0912	Albersmeier, F., D. Mörlein u. A. Spiller	Zur Wahrnehmung der Qualität von Schweinefleisch beim Kunden
0913	Ihle, R., B. Brümmer u. S. R. Thompson	Spatial Market Integration in the EU Beef and Veal Sector: Policy Decoupling and Export Bans
	2010	
1001	Heß, S., S. von Cramon-Taubadel u. S. Sperlich	Numbers for Pascal: Explaining differences in the estimated Benefits of the Doha Development Agenda

1002	Deimel, I., J. Böhm u. B. Schulze	Low Meat Consumption als Vorstufe zum Vegetarismus? Eine qualitative Studie zu den Motivstrukturen geringen Fleischkonsums
1003	Franz, A. u. B. Nowak	Functional food consumption in Germany: A lifestyle segmentation study
1004	Deimel, M. u. L. Theuvsen	Standortvorteil Nordwestdeutschland? Eine Untersuchung zum Einfluss von Netzwerk- und Clusterstrukturen in der Schweinefleischerzeugung
1005	Niens, C. u. R. Marggraf	Ökonomische Bewertung von Kindergesundheit in der Umweltpolitik - Aktuelle Ansätze und ihre Grenzen
1006	Hellberg-Bahr, A., M. Pfeuffer, N. Steffen, A. Spiller u. B. Brümmer	Preisbildungssysteme in der Milchwirtschaft -Ein Überblick über die Supply Chain Milch
1007	Steffen, N., S. Schlecht, H-C. Müller u. A. Spiller	Wie viel Vertrag braucht die deutsche Milchwirtschaft?- Erste Überlegungen zur Ausgestaltung des Contract Designs nach der Quote aus Sicht der Molkereien
1008	Prehn, S., B. Brümmer u. S. R. Thompson	Payment Decoupling and the Intra – European Calf Trade
1009	Maza, B., J. Barkmann, F. von Walter u. R. Marggraf	Modelling smallholders production and agricultural income in the area of the Biosphere reserve "Podocarpus - El Cóndor", Ecuador
1010	Busse, S., B. Brümmer u. R. Ihle	Interdependencies between Fossil Fuel and Renewable Energy Markets: The German Biodiesel Market
	2011	
1101	Mylius, D., S. Küest, C. Klapp u. L. Theuvsen	Der Großvieheinheitenschlüssel im Stallbaurecht - Überblick und vergleichende Analyse der Abstandsregelungen in der TA Luft und in den VDI-Richtlinien
1102	Klapp, C., L. Obermeyer u. F. Thoms	Der Vieheinheitenschlüssel im Steuerrecht - Rechtliche Aspekte und betriebswirtschaftliche Konsequenzen der Gewerblichkeit in der Tierhaltung
1103	Göser, T., L. Schroeder u. C. Klapp	Agrarumweltprogramme: (Wann) lohnt sich die Teilnahme für landwirtschaftliche Betriebe?

1104	Plumeyer, C.-H., F. Albersmeier, M. Freiherr von Oer, C. H. Emmann u. L. Theuvsen	Der niedersächsische Landpachtmarkt: Eine empirische Analyse aus Pächtersicht
1105	Voss, A. u. L. Theuvsen	Geschäftsmodelle im deutschen Viehhandel: Konzeptionelle Grundlagen und empirische Ergebnisse
1106	Wendler, C., S. von Cramon-Taubadel, H. de Haen, C. A. Padilla Bravo u. S. Jrad	Food security in Syria: Preliminary results based on the 2006/07 expenditure survey
1107	Prehn, S. u. B. Brümmer	Estimation Issues in Disaggregate Gravity Trade Models
1108	Recke, G., L. Theuvsen, N. Venhaus u. A. Voss	Der Viehhandel in den Wertschöpfungsketten der Fleischwirtschaft: Entwicklungstendenzen und Perspektiven
1109	Prehn, S. u. B. Brümmer	"Distorted Gravity: The Intensive and Extensive Margins of International Trade", revisited: An Application to an Intermediate Melitz Model
2012		
1201	Kayser, M., C. Gille, K. Suttorp u. A. Spiller	Lack of pupils in German riding schools? – A causal-analytical consideration of customer satisfaction in children and adolescents
1202	Prehn, S. u. B. Brümmer	Bimodality & the Performance of PPML
1203	Tangermann, S.	Preisanstieg am EU-Zuckermarkt: Bestimmungsgründe und Handlungsmöglichkeiten der Marktpolitik
1204	Würriehausen, N., S. Lakner u. Rico Ihle	Market integration of conventional and organic wheat in Germany
1205	Heinrich, B.	Calculating the Greening Effect – a case study approach to predict the gross margin losses in different farm types in Germany due to the reform of the CAP
1206	Prehn, S. u. B. Brümmer	A Critical Judgement of the Applicability of 'New New Trade Theory' to Agricultural: Structural Change, Productivity, and Trade
1207	Marggraf, R., P. Masius u. C. Rumpf	Zur Integration von Tieren in wohlfahrtsökonomischen Analysen
1208	S. Lakner, B. Brümmer, S. von Cramon-Taubadel J. Heß, J. Isselstein, U. Liebe,	Der Kommissionsvorschlag zur GAP-Reform 2013 - aus Sicht von Göttinger und Witzenhäuser Agrarwissenschaftler(inne)n

	R. Marggraf, O. Mußhoff, L. Theuvsen, T. Tscharntke, C. Westphal u. G. Wiese	
1209	Prehn, S., B. Brümmer u. T. Glauben	Structural Gravity Estimation & Agriculture
1210	Prehn, S., B. Brümmer u. T. Glauben	An Extended Viner Model: Trade Creation, Diversion & Reduction
1211	Salidas, R. u. S. von Cramon-Taubadel	Access to Credit and the Determinants of Technical Inefficiency among Specialized Small Farmers in Chile
1212	Steffen, N. u. A. Spiller	Effizienzsteigerung in der Wertschöpfungskette Milch ? -Potentiale in der Zusammenarbeit zwischen Milcherzeugern und Molkereien aus Landwirtssicht
1213	Mußhoff, O., A. Tegtmeier u. N. Hirschauer	Attraktivität einer landwirtschaftlichen Tätigkeit - Einflussfaktoren und Gestaltungsmöglichkeiten
	2013	
1301	Lakner, S., C. Holst u. B. Heinrich	Reform der Gemeinsamen Agrarpolitik der EU 2014 - mögliche Folgen des Greenings für die niedersächsische Landwirtschaft
1302	Tangermann, S. u. S. von Cramon-Taubadel	Agricultural Policy in the European Union : An Overview
1303	Granoszewski, K. u. A. Spiller	Langfristige Rohstoffsicherung in der Supply Chain Biogas : Status Quo und Potenziale vertraglicher Zusammenarbeit
1304	Lakner, S., C. Holst, B. Brümmer, S. von Cramon-Taubadel, L. Theuvsen, O. Mußhoff u. T.Tscharntke	Zahlungen für Landwirte an gesellschaftliche Leistungen koppeln! - Ein Kommentar zum aktuellen Stand der EU-Agrarreform
1305	Prechtel, B., M. Kayser u. L. Theuvsen	Organisation von Wertschöpfungsketten in der Gemüseproduktion : das Beispiel Spargel
1306	Anastassiadis, F., J.-H. Feil, O. Musshoff u. P. Schilling	Analysing farmers' use of price hedging instruments : an experimental approach
1307	Holst, C. u. S. von Cramon-Taubadel	Trade, Market Integration and Spatial Price Transmission on EU Pork Markets following Eastern Enlargement

1308	Granoszewki, K., S. Sander, V. M. Aufmkolk u. A. Spiller	Die Erzeugung regenerativer Energien unter gesellschaftlicher Kritik : Akzeptanz von Anwohnern gegenüber der Errichtung von Biogas- und Windenergieanlagen
	2014	
1401	Lakner, S., C. Holst, J. Barkmann, J. Isselstein u. A. Spiller	Perspektiven der Niedersächsischen Agrarpolitik nach 2013 : Empfehlungen Göttinger Agrarwissenschaftler für die Landespolitik
1402	Müller, K., Mußhoff, O. u. R. Weber	The More the Better? How Collateral Levels Affect Credit Risk in Agricultural Microfinance
1403	März, A., N. Klein, T. Kneib u. O. Mußhoff	Analysing farmland rental rates using Bayesian geoadditive quantile regression
1404	Weber, R., O. Mußhoff u. M. Petrick	How flexible repayment schedules affect credit risk in agricultural microfinance
1405	Haverkamp, M., S. Henke, C., Kleinschmitt, B. Möhring, H., Müller, O. Mußhoff, L., Rosenkranz, B. Seintsch, K. Schlosser u. L. Theuvsen	Vergleichende Bewertung der Nutzung von Biomasse : Ergebnisse aus den Bioenergieregionen Göttingen und BERTA
1406	Wolbert-Haverkamp, M. u. O. Musshoff	Die Bewertung der Umstellung einer einjährigen Ackerkultur auf den Anbau von Miscanthus – Eine Anwendung des Realoptionsansatzes
1407	Wolbert-Haverkamp, M., J.-H. Feil u. O. Musshoff	The value chain of heat production from woody biomass under market competition and different incentive systems: An agent-based real options model
1408	Ikinger, C., A. Spiller u. K. Wiegand	Reiter und Pferdebesitzer in Deutschland (Facts and Figures on German Equestrians)
1409	Mußhoff, O., N. Hirschauer, S. Grüner u. S. Pielsticker	Der Einfluss begrenzter Rationalität auf die Verbreitung von Wetterindexversicherungen : Ergebnisse eines internetbasierten Experiments mit Landwirten
1410	Spiller, A. u. B. Goetzke	Zur Zukunft des Geschäftsmodells Markenartikel im Lebensmittelmarkt
1411	Wille, M.	‚Manche haben es satt, andere werden nicht satt' : Anmerkungen zur polarisierten Auseinandersetzung um Fragen des globalen Handels und der Welternährung

1412	Müller, J., J. Oehmen, I. Janssen u. L. Theuvsen	Sportlermarkt Galopprennsport : Zucht und Besitz des Englischen Vollbluts

2015		
1501	Hartmann, L. u. A. Spiller	Luxusaffinität deutscher Reitsportler : Implikationen für das Marketing im Reitsportsegment
1502	Schneider, T., L. Hartmann u. A. Spiller	Luxusmarketing bei Lebensmitteln : eine empirische Studie zu Dimensionen des Luxuskonsums in der Bundesrepublik Deutschland
1503	Würriehausen, N. u. S. Lakner	Stand des ökologischen Strukturwandels in der ökologischen Landwirtschaft
1504	Emmann, C. H., D. Surmann u. L. Theuvsen	Charakterisierung und Bedeutung außerlandwirt-schaftlicher Investoren : empirische Ergebnisse aus Sicht des landwirtschaftlichen Berufsstandes
1505	Buchholz, M., G. Host u. Oliver Mußhoff	Water and Irrigation Policy Impact Assessment Using Business Simulation Games : Evidence from Northern Germany
1506	Hermann, D.,O. Mußhoff u. D. Rüther	Measuring farmers‘ time preference : A comparison of methods
1507	Riechers, M., J. Barkmann u. T. Tscharntke	Bewertung kultureller Ökosystemleistungen von Berliner Stadtgrün entlang eines urbanen-periurbanen Gradienten
1508	Lakner, S., S. Kirchweger, D. Hopp, B. Brümmer u. J. Kantelhardt	Impact of Diversification on Technical Efficiency of Organic Farming in Switzerland, Austria and Southern Germany
1509	Sauthoff, S., F. Anastassiadis u. O. Mußhoff	Analyzing farmers‘ preferences for substrate supply contracts for sugar beets
1510	Feil, J.-H., F. Anastassiadis, O. Mußhoff u. P. Kasten	Analyzing farmers‘ preferences for collaborative arrangements : an experimental approach
1511	Weinrich, R., u. A. Spiller	Developing food labelling strategies with the help of extremeness aversion
1512	Weinrich, R., A. Franz u. A. Spiller	Multi-level labelling : too complex for consumers?
1513	Niens, C., R. Marggraf u. F. Hoffmeister	Ambulante Pflege im ländlichen Raum : Überlegungen zur effizienten Sicherstellung von Bedarfsgerechtigkeit
1514	Sauter, P., D. Hermann u. O. Mußhoff	Risk attitudes of foresters, farmers and students : An experimental multimethod comparison
2016		

1601	Magrini, E., J. Balie u. C. Morales Opazo	Price signals and supply responses for stable food crops in SSAS countries
1602	Feil, J.-H.	Analyzing investment and disinvestment decisions under uncertainty, firm-heterogeneity and tradable output permits
1603	Sonntag, W. u. A. Spiller	Prozessqualitäten in der WTO : Ein Vorschlag für die reliable Messung von moralischen Bedenken
1604	Wiegand, K.	Marktorientierung von Reitschulen – zwischen Vereinsmanagement und Dienstleistungsmarketing
1605	Ikinger, C. M. u. A. Spiller	Tierwohlbewusstsein und –verhalten von Reitern : Die Entwicklung eines Modells für das Tierwohlbewusstsein und –verhalten im Reitsport
1606	Zinngrebe, Yves	Incorporating Biodiversity Conservation in Peruvian Development : A history with different episodes
1607	Balié, J., E. Magrini u. C. Morales Opazo	Cereal Price Shocks and Volatility in Sub-Saharan Africa : what does really matter for Farmers‘ Welfare?
1608	Spiller, A., M. von Meyer-Höfer u. W. Sonntag	Gibt es eine Zukunft für die moderne konventionelle Tierhaltung in Nordwesteuropa?
1609	Gollisch, S., B. Hedderich u. L. Theuvsen	Reference points and risky decision-making in agricultural trade firms : A case study in Germany
1610	Cárcamo, J. u. S. von Cramon-Taubadel	Assessing small-scale raspberry producers’ risk and ambiguity preferences : evidence from field-experiment data in rural Chile
1611	García-Germán, S., A. Romeo, E. Magrini u. J. Balié	The impact of food price shocks on weight loss : Evidence from the adult population of Tanzania
	2017	
1701	Vollmer, E. u. D. Hermann, O. Mußhoff	The disposition effect in farmers‘ selling behavior – an experimental investigation
1702	Römer, U., O. Mußhoff, R. Weber u. C. G. Turvey	Truth and consequences : Bogus pipeline experiment in informal small business lending
1703	Römer, U. u. O. Mußhoff	Can agricultural credit scoring for microfinance institutions be implemented and improved by weather data?
1704	Gauly, S., S. Kühl u. A. Spiller	Uncovering strategies of hidden intention in multi-stakeholder initiatives : the case of pasture-raised milk
1705	Gauly, S., A. Müller u. A. Spiller	New methods of increasing transparency : Does viewing webcam pictures change peoples‘ opinions towards modern pig farming?

1706	Bauermeiser, G.-F. u. O. Mußhoff	Multiple switching behavior in different display formats of multiple price lists
1707	Sauthoff, S., M. Danne u. O. Mußhoff	To switch or not to switch? – Understanding German consumers‘ willingness to pay for green electricity tariff attributes
1708	Bilal, M., J. Barkmann u. T. Jamali Jaghdani	To analyse the suitability of a set of social and economic indicators that assesses the impact on SI enhancing advanced technological inputs by farming households in Punjab Pakistan
1709	Heyking, C.-A. von u. T. Jamali Jaghdani	Expansion of photovoltaic technology (PV) as a solution for water energy nexus in rural areas of Iran; comparative case study between Germany and Iran
1710	Schueler, S. u. E. M. Noack	Naturschutz und Erholung im Stadtwald Göttingen: Darstellung von Interessenskonflikten anhand des Konzeptes der Ökosystemleistungen
2018		
1801	Danne, M. u. O. Mußhoff	Producers’ valuation of animal welfare practices: Does herd size matter?
1802	Danne, M., O. Mußhoff u. M. Schulte	Analysing the importance of glyphosate as part of agricultural strategies – a discrete choice experiment
1803	Fecke, W., M. Danne u. O. Mußhoff	E-commerce in agriculture – The case of crop protection product purchases in a discrete choice experiment
1804	Viergutz, Tim u. A. Spiller	The use of hybrid scientometric clustering for systematic literature reviews in business and economics
1805	Schulze Schwering, D. u. A. Spiller	Das Online-Einkaufsverhalten von Landwirten im Bereich landwirtschaftlicher Betriebsmittel

Diskussionspapiere
2000 bis 31. Mai 2006:
Institut für Rurale Entwicklung
Georg-August-Universität, Göttingen)
Ed. Winfried Manig (ISSN 1433-2868)

32	Dirks, Jörg J.	Einflüsse auf die Beschäftigung in nahrungsmittelverabeitenden ländlichen Kleinindustrien in West-Java/Indonesien, 2000
33	Keil, Alwin	Adoption of Leguminous Tree Fallows in Zambia, 2001
34	Schott, Johanna	Women's Savings and Credit Co-operatives in Madagascar, 2001
35	Seeberg-Elberfeldt, Christina	Production Systems and Livelihood Strategies in Southern Bolivia, 2002
36	Molua, Ernest L.	Rural Development and Agricultural Progress: Challenges, Strategies and the Cameroonian Experience, 2002
37	Demeke, Abera Birhanu	Factors Influencing the Adoption of Soil Conservation Practices in Northwestern Ethiopia, 2003
38	Zeller, Manfred u. Julia Johannsen	Entwicklungshemmnisse im afrikanischen Agrarsektor: Erklärungsansätze und empirische Ergebnisse, 2004
39	Yustika, Ahmad Erani	Institutional Arrangements of Sugar Cane Farmers in East Java – Indonesia: Preliminary Results, 2004
40	Manig, Winfried	Lehre und Forschung in der Sozialökonomie der Ruralen Entwicklung, 2004
41	Hebel, Jutta	Transformation des chinesischen Arbeitsmarktes: gesellschaftliche Herausforderungen des Beschäftigungswandels, 2004
42	Khan, Mohammad Asif	Patterns of Rural Non-Farm Activities and Household Acdess to Informal Economy in Northwest Pakistan, 2005
43	Yustika, Ahmad Erani	Transaction Costs and Corporate Governance of Sugar Mills in East Java, Indovesia, 2005
44	Feulefack, Joseph Florent, Manfred Zeller u. Stefan Schwarze	Accuracy Analysis of Participatory Wealth Ranking (PWR) in Socio-economic Poverty Comparisons, 2006

Die Wurzeln der **Fakultät für Agrarwissenschaften** reichen in das 19. Jahrhundert zurück. Mit Ausgang des Wintersemesters 1951/52 wurde sie als siebente Fakultät an der Georgia-Augusta-Universität durch Ausgliederung bereits existierender landwirtschaftlicher Disziplinen aus der Mathematisch-Naturwissenschaftlichen Fakultät etabliert.

1969/70 wurde durch Zusammenschluss mehrerer bis dahin selbständiger Institute das **Institut für Agrarökonomie** gegründet. Im Jahr 2006 wurden das Institut für Agrarökonomie und das Institut für Rurale Entwicklung zum heutigen **Department für Agrarökonomie und Rurale Entwicklung** zusammengeführt.
Das Department für Agrarökonomie und Rurale Entwicklung besteht aus insgesamt neun Lehrstühlen zu den folgenden Themenschwerpunkten:

- Agrarpolitik
- Betriebswirtschaftslehre des Agribusiness
- Internationale Agrarökonomie
- Landwirtschaftliche Betriebslehre
- Landwirtschaftliche Marktlehre
- Marketing für Lebensmittel und Agrarprodukte
- Soziologie Ländlicher Räume
- Umwelt- und Ressourcenökonomik
- Welternährung und rurale Entwicklung

In der Lehre ist das Department für Agrarökonomie und Rurale Entwicklung führend für die Studienrichtung Wirtschafts- und Sozialwissenschaften des Landbaus sowie maßgeblich eingebunden in die Studienrichtungen Agribusiness und Ressourcenmanagement. Das Forschungsspektrum des Departments ist breit gefächert. Schwerpunkte liegen sowohl in der Grundlagenforschung als auch in angewandten Forschungsbereichen. Das Department bildet heute eine schlagkräftige Einheit mit international beachteten Forschungsleistungen.

Georg-August-Universität Göttingen
Department für Agrarökonomie und Rurale Entwicklung
Platz der Göttinger Sieben 5
37073 Göttingen
Tel. 0551-39-4819
Fax. 0551-39-12398
Mail: biblio1@gwdg.de
Homepage : http://www.uni-goettingen.de/de/18500.html