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# Collaboration Wageningen University & Research and Colombia



**WAGENINGEN**  
UNIVERSITY & RESEARCH

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## Preface

Colombia is the fourth biggest economy in Latin America with a relatively stable economic growth over the past years of up to 3%. During the last decade, the social and economic indicators in Colombia have shown, on average, a positive trend. The middle class in Colombia is growing steadily and the country has huge potential in the sustainable development of rural areas. There is a need for more, better and affordable food that is produced sustainably and energy production for the growing urban populations in Colombia and in the region. At the same time, conservation of biodiversity is essential, creating a need for optimal and circular production methods in order to prevent agriculture production from extending to nature areas.

As President of Wageningen University & Research (WUR), I am proud that for many years we have received Colombian students at our university and have implemented research projects and programmes together with our Colombian partners. This brochure gives an overview of the work we have been doing in Colombia and with Colombian partners on a diversity of topics.

We look forward to strengthening our present ties with strategic national and global partners in Colombia like Agrosavia, CIAT and Universidad Nacional de Colombia, and to establishing new partnerships to help consolidate sustainable rural and urban development.



Prof.dr. *ir.* Louise O. Fresco  
President Executive Board, Wageningen  
University & Research



# COLOMBIA

Santa Marta  
Barranquilla  
Cartagena  
Montería  
Cúcuta  
Bucaramanga  
BOGOTÁ  
Ibagué  
Cali  
Pasto

Maracaibo  
Valledupar  
Cabimas  
Barinas  
San Cristóbal

Gulf of Darien  
Gulf of Venezuela  
Lake Maracaibo

Cauca  
Magdalena  
Cauqueta  
Putumayo

AMBA  
L I A

QUITO  
ECUADOR  
Ambato  
Riobamba  
Babahoyo  
Cuenca



## Introduction

This booklet gives you an overview of projects Wageningen University & Research is implementing or has implemented in the past 5 years in Colombia and/or with Colombian partners, including some research projects of Colombian PhD candidates that are doing their doctoral research in an area that is potentially interesting to Colombia.

The overview is far from complete, hence the relationships shown between WUR and Colombia date from 1955 as that is the year of publication of the oldest article/book in our library named: "Colombia; the country and its forest" by P. Bussinger (1955). Publications of research results done by Wageningen University & Research in Colombia went from forestry to sociology, from plant breeding, phytopathology and the food sciences to soils biology and chemistry, and from the phytogeography of the Páramo flora of the high Andes mountains to how the ancient people shaped the Amazon rainforest.

As this booklet shows, the current research and work of Wageningen University & Research in and with Colombia is still in the same disciplines and fundamentals of agriculture, husbandry, biodiversity, environment, food, sociology and agro-economics and has slowly moved to find more sustainability, circularity and equality to "improve quality of life".

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## Colombian students

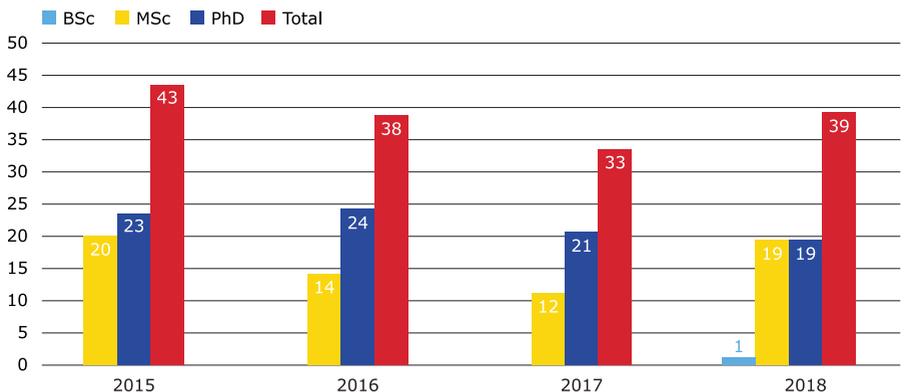
"My name is Bibiana Duarte,



*I am from Colombia and I attended the master International Land and Water Management from 2008 to 2010. During my master, I had the opportunity to meet professors and various academics who were working in understanding water issues around the world. I had the opportunity to become part of an international research network which is called Water Justice. Thanks to that, I could interchange different points of views and knowledge about the relations between water management, societies, and landscapes transformations."*

In this academic year 2018-2019, Wageningen University & Research has 39 students from Colombia: 19 MSc students, 19 PhD candidates and 1 BSc student (first time!). This makes Colombia the third country of Latin America in Wageningen, after Mexico (80 students) and Ecuador (40 students).

In 2018 we count 146 alumni from Colombia who have graduated from Wageningen University & Research. 50 Wageningen alumni do live in Colombia.





September 2018 - Total budget: € 70,000.-

In September 2018 a group of Colombian business leaders from the Antioquia region visited the Wageningen Campus as part of the Comfama Agtech mission in the Netherlands. The programme was developed together with the Holland House Colombia. The programme addressed several topics, like agricultural technology, development models, productive alliances (Academic, Private, Public and the people), and public-private development schemes for agricultural development. These subjects all related to the overall question of the Agtech mission, namely:

*How can we make better progress in the consolidation of Colombia's rural sector, so that it transforms into a true driving force for the country's development, understanding its social needs, productive development, employment formalisation, as well as considering the rural sector from a business perspective? How can we work together to achieve this goal?*

The programme contained lectures, given by Academic and business experts, and several study visits. One of the participants stated the following quote:

*"The AgTech mission surpassed my expectations, as a grower I think that anyone involved in the agriculture industry should visit Wageningen University & Research to really understand where the industry is heading."*

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A photograph of several avocados hanging from a tree branch, surrounded by green leaves. The avocados are in various stages of ripeness, from green to dark purple.

# Quality Standard Avocado

From 2017-2018 - Total budget: € 33,000.-

Colombia is a new sourcing area of Hass avocados. It is an interesting production region for Dutch importers, as global demand for avocados is increasing. However, the experiences with quality of Colombian avocados are not yet as good as from other regions. This could be due to differences in growing conditions and expertise, climatic challenges, but also due to lack of standard operating procedures and post-harvest infrastructure.

A project was set up between CBI (Centre for the promotion of imports from developing countries), Wageningen Food & Biobased Research and AgroSavia (former Corpoica) within the program Tropical and Exotic Fresh Fruit, to get a better understanding of the variability in quality and help to develop a standard quality protocol for the export of Colombian Hass avocados.

The project consisted of an assessment of local Colombian situation and interviews with experiences from importers. Based on the insights of this assessment 2 pilot shipments of avocados from different growers, harvest seasons, post-harvest treatments were performed. Because of a unique cooperation it was possible to assess quality of these avocados already after harvest and follow them during transport and after arrival and shelf life. Results were presented via a successful webinar to Colombian producers, traders, consultants and researcher all over the country.

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# Sustainability certification in the banana sector

2016 and 2018 - Total budget RA: € 68,000.- FT: € 180,000.-

Bananas are one of the most important export crops of Colombia, and Colombia is one of the most important countries for the global banana sector. Wageningen Economic Research has been commissioned twice over the past few years to collect baseline data and research the differences between certified and non-certified banana plantations in Colombia. A few years ago by Fairtrade, and more recently by Rainforest Alliance (not yet published).

Both studies focus on hired labourers on the plantations. The Fair trade research was done in 3 countries, among others Colombia. Some of the results of the FT research were that even though there was no difference in wages, workers on certified plantations received more in-kind benefits than workers on non-certified plantations. Also, workers have more trust in the worker union on Fairtrade than on non-Fairtrade plantations.

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# Biorefinery of sugar cane & oil palm residue

Fairtrade 2013-2017 - Total budget: € 600,000.-

Between 2013 and 2017 a joint project was executed between Wageningen Food & Biobased Research and Colombian partners Cenipalma, Cenicaña, Aceites S.A., and Palmaceite S.A. on bio refinery of sugar cane and oil palm residue.

Colombia has several large commodity crops (oil palm, sugar cane, banana, coffee) which produce considerable amounts of by-products. Making added value products for the bio-based economy will add value for the farmer and processing industries, it will increase rural employment, it may help reduce local pollution problems, it can create an export opportunity. The by-products should also be an excellent feedstock for producing advanced biofuels and chemicals and other products. Markets for these products may lie both in Colombia and abroad. Among other an assessment was made of potential to use crop residues showing that until 2030 between 1 and 4 million tons of sugar cane residues from the Cauca area could be used for bio based applications and 250.000 to 750.000 tons of oil palm residue from the northern and central regions could be made available for bio based applications or export.

The interaction with Colombian partners was effectuated by jointly supervising students stationed in Colombia with partners or students working on conversion of Colombia biomass in The Netherlands. Overall 10 students executed projects in the program. The results of the project are starting points for further collaborations and business initiatives using these crops residues in Colombia or abroad.

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# Climate Smart Coffee

From 2013-2018 - Total budget: € 20,000,000.-

Coffee cultivation in Colombia is suffering from climate change. Due to drought, heavy rains and erosion, harvests lag behind and uncertainty about the incomes of half a million small farmers prevails.

The programme yielded the participation of eleven thousand coffee growing families, fifty public, private and civil organisations linked to water management and covers more than 41.000 hectares and 25 Colombian river basins in the Andes Mountains. It developed a climate adaptation model, implementing technologies that reduce production losses from climate hazards and that lower the environmental impacts of coffee production on the environment.

The innovative programme was led by the Colombian Coffee Growers Federation (FNC), the Dutch Ministry of Foreign Affairs, the Presidential Agency for International Cooperation (APC Colombia), the multinational companies Nestlé and Nespresso, Wageningen University & Research and Cenicafé. WUR ensured the access to the most advanced knowledge and technology on water management, climate smart agriculture and participative decision support tools.

The project won first place in the business category of Colombia's 13th Planeta Azul (Blue Planet) National Ecology Award.

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# Network for mitigation of high cadmium levels in cacao

2018 - Total budget: Pipeline

In January 2019 the EU will apply new food safety regulation on maximum concentration of cadmium in cocoa products. Cadmium is a trace metal that is present in the soil, is taken up by the plant and accumulates in cacao beans. If consumed in high amounts, cadmium can be harmful to human health. Cacao from the Andean countries has on average a high level of cadmium. There is great concern about the economic and social implications of the EU regulation, since cacao is mostly produced by smallholders and promoted as an alternative to illegal crops in conflict zones. Clear information on the risks associated with cadmium, as well as cost-effective solutions to reduce cadmium levels in cocoa beans, are lacking.

WUR supports research and capacity building on Cadmium in Cacao, through participation in the international network "CacaoCdFREE". This network, led by CIAT and CIRAD, was initiated during a workshop with 50 researchers, producer federations, government, dev. cooperation and industry of Colombia, Ecuador and Peru, held in March 2018 in Colombia. The group developed a research action plan focusing on: SOIL-PLANT (improve accessibility, harmonisation & quality of data and research protocols; evaluation of agronomic practices to reduce cadmium in beans; screening & evaluation of low cadmium accumulating genotypes) and SOCIOECONOMICS (ex-ante assessment of impacts of regulation, cost-benefits of possible mitigation measures, stimulating adoption of best practices). To implement the research agenda several joint research proposals have been developed.

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# Colombian cut flower competitiveness

2016 - Total budget: € 20,000.-

To maintain competitiveness and its position as the world's second biggest producer of cut flowers Colombian growers will have to improve the technological situation of the greenhouse production. This was the conclusion of an analysis of the technological situation of the cut flower sector conducted by the Business Unit Greenhouse Horticulture of Wageningen University & Research for the Dutch greenhouse supply industry and Holland House (Colombia).

A step wise, model supported approach (Adaptive Greenhouse Model) was proposed to enable a sustainable transition from low tech to mid tech, and from mid tech to high tech. Technical improvement will help mitigate the consequences of climate change and increasing labour costs. Starting with optimized, controlled natural ventilation to reduce heat load due to high sun radiation and the introduction of thermal screens to reduce heat losses during the cold nights.

Further steps add night dehumidification and CO<sub>2</sub> supply, the introduction of integrated pest control strategies, soilless cultivation and mechanisation of post-harvest activities. Model validation of the impact of each step and demonstration and training in the use of technology are key elements for a successful transition.

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# The Netherlands Dairy Capacity and Business development project (Dairy Cab)

From: 2013-2018 - Total budget: € 521,000.-

DairyCaB supports dairy farm development in Antioquia highlands by capacity building and business development. The project is implemented by Wageningen Livestock Research (WLR) in cooperation with private and public partners in both countries: the University of Antioquia, Barenbrug, Saenz Fety and Eurofins. The project is financially supported by the Transition Facility of the Dutch Ministry of Foreign Affairs.

Project objectives: 1) Demonstration, testing and dissemination of innovations to improve dairy farm performance and 2) capacity building and training of farm advisors and farmers. Main innovations tested and demonstrated are improving kikuyu grass and silvo-pastoral pastures by introduction of ryegrass, better pasture management and fodder conservation, balancing of rations of grazing cows, feed analysis using NIRS techniques, calf rearing using milk replacer and use of farm data for farm management.

The interventions were tested and demonstrated at the university farm of Universidad de Antioquia and two different private farms. Results show that improvement of pasture with rye grass leads to a higher cow productivity and a mixture of rye grass and kikuyu grass performs better than pure rye grass pastures. A total of 1600 people, university staff, farm advisors and farmers, have been trained. WLR provided technical expertise on pasture cultivation, cow nutrition, farm management and project management.

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# “Water and Sugar” a documentary project

From: 2016-2018 - Total budget: € 18,000.-

The documentary project “Water and sugar; to industrialise or to liberate the land?” shows in a mosaic narrative the situation around sugar cane, land and water use from different perspectives in the Cauca Valley of Colombia.

The film documentary is based on the academic research on water politics and conflict, by the Water Resources Management group of Wageningen University & Research. Throughout the story, the spectator gets acquainted with the daily lives of people living and working in the Cauca Valley and the way their lives are affected by sugar cane mono-cropping: Afro-Colombian elders reminiscing the past, youngsters dreaming about their future, agricultural engineers keen on sugar cane and the NASA indigenous people who want to free the land for other crops and build sustainable and dignified livelihoods.

Produced under the umbrella of the Water Justice alliance, the documentary project gives insight in Colombia’s paradox: where the peace process and turbulent political situation demand continuous attention, the situation of injustice in land and water distribution is often underexposed. ‘Water and Sugar’ is filmed and edited in 2016/2017 by a Colombian/Dutch crew. It is part of an ongoing Wageningen University & Research – film documentary series, soon online available on [www.justiciahidrica.org](http://www.justiciahidrica.org) and accessible to a broad public, both nationally and internationally.

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# Flies are what they eat:

From: 2014-2018 - Total budget: € 150,000.-

## Tailoring nutrition of Black Soldier Fly (*Hermetia illucens* L.) for larval biomass production and fitness

Black Soldier Fly – BSF; *Hermetia illucens* L. (Diptera: Stratiomyidae) has been proposed as one of the most suitable insect species to be used as animal feed. Advantages of using BSF that have been identified are their capacity to convert organic waste, to reduce the numbers of certain harmful bacteria and insect pests, to provide potential chemical precursors to produce biodiesel, and to provide high quality protein to be used as feed for a variety of animals.

This thesis explores nutritional physiology of BSF and its effect on larval biomass production and fitness. Knowing the physiological mechanisms that BSF employs to deal with different nutrient concentrations, and their impacts on BSF life-history traits and larval body content, may yield valuable insights into the nutritional ecology of BSF. Experiments involving the study of larval densities, total nutrient content, and dietary protein (P) and carbohydrate (C) content and ratio on artificial, semi-artificial and organic residual stream diets were used to unravel their effect on life-history traits, body nutrient content and reproduction of BSF. The data presented in this thesis contribute to our understanding of how nutrition, mainly in terms of protein and carbohydrate content and ratio, affects life-history traits, nutrient body content and reproduction of BSF and how this knowledge can be applied to improve the productive performance and larval body composition in BSF production systems.

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# Paraguay: Latin American Water Master Programmes

From: 2012-2015 - Total budget: € 1,500,000.-

The Paraguay program was led by the Water Resources Management group (WRM) of Wageningen University & Research and financed by the European Commission programme ALFAIII. It established a network of Latin American Postgraduate Programs in water governance. The network consisted of water master programs at five universities in Colombia, Ecuador, Peru, Bolivia and Mexico. The overall objective of the programme was to develop highly qualified professionals in water governance through postgraduate programmes in the Latin America with innovative, critical and interdisciplinary training. These professionals will contribute to the construction of strategies and policies for managing water with an orientation towards sustainability and water justice.

### **Paraguay achieved the three main objectives of the project:**

- 1 The institutionalisation of a permanent network of exchange and cooperation between the universities and collaboration with the Water Justice Alliance;
- 2 Establishment and improvement of five post-graduate programmes in water governance of high quality and with a common part in the curriculum;
- 3 Improved applied and participatory research within the postgraduate programmes in coordination with the public sector and water users' organisations.

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# Working on peace with one another and with nature

From: 2005-ongoing - Total budget: € 750,000.-

Colombians have been at war with themselves and with Nature for nearly 200 years. Since 2005, the Sociology of Development and Change group (SDC) has committed to peace-promoting research and activities in different domains.

A first area is that of capacity building at HLE. This has been achieved through participation in two Nuffic NPTs, guest professorships (UNAL, UJTL, UIS, Universidad de Antioquia), PhD research, and two-way student exchange. A second area involves research into the relationship between Amazonian Indigenous people, the use of natural resources (e.g. gold mining), illegal armed groups, and the Colombian institutional environment (e.g. UESPNN, local environmental governance authorities). A third domain involves action research on the implementation of the Peace Accord (esp. as regards the RRI and the reincorporation of ex-combatants in civic life). Finally, SDC works with/on wider civil society efforts to bring about peace (e.g. the political voice of victims of displacement; the ecovillages movement).

In the near future SDC is intent on further pursuing these lines of engagement through close collaboration with the EUTF, Nuffic, political parties, governmental institutions (e.g. land titling), peasant- and Indigenous organisations, and wider social movements in pursuit of peace.

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# Collaboration in Plant Breeding

From: 2016-2017 - Total budget: € 150,000.-

In 2016 a refresher course entitled "breeding for durable resistance against specialized Plant pathogen in food crops". The course was implemented by a WUR plant breeding team, financed by NUFFIC and held in collaboration with Universidad Catolica de Oriente (UCO) at Rionegro. In total 20 professional Colombian plant breeders, plant pathologists and agronomists attended.

In 2017, a tailor made course was organised in collaboration with the Colombian Corporation for Agriculture Research; AGROSAVIA (formerly CORPOICA) in Rionegro titled: "Modern plant approaches to abiotic and abiotic stress factors". The course lasted for two weeks, was financed by Nuffic and implemented by a WUR-Plant breeding team.

AGROSAVIA is interested in modernising the national breeding programmes in the country with more focus on cocoa, avocado and banana. Together with AGROSAVIA, a concept proposal to strengthen the Avocado value chain has been developed.

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# Regional Learning trajectory

From: 2016-2019 - Total budget: € 40,000.-

Wageningen Centre for Development Innovation (WCDI) provided MSP learning events for various partner organisations of Woord en Daad, an International Dutch NGO, in 2016, among which in Colombia.

As a follow up of these events it was decided to create a multi-year learning trajectory to follow in more detail the implementation and learning of several chosen Multi Stakeholder Process (MSP) principles, as well as a combination with learning on “inclusion” as a more integral theme in the programs. Based on the context of the partner organisation a choice was made for key learning questions which can guide the organisation in generating insight in the actual implementation of the MSP principles. This sharpens the organisational capacity to interact well in MSP settings. WCDI at the same time gains insight in the reality that MSP trainees face in implementing these principles.

In Colombia the learning questions of the partner organisation focuses on applying the MSP principle of creating a learning environment (7th principle) on the partnership work done by Conviventia as well as analysing the current inclusivity policy of Conviventia and how its “Inclusiveness in Practice” could be improved.

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# Nematode resistance in vegetable crops

From: 2016-2019 - Total budget: € 300,000.-

Parasitic nematodes are a serious threat to global food security. Because of serious environmental and health concerns, most pesticides to control nematodes face a global ban. Moreover, rising soil temperatures due to global warming result in a rapid expansion world-wide of areas infested with plant parasitic nematodes, especially root-knot nematodes.

The growth of resistant cultivars is in principle an attractive alternative for pesticides, but current nematode resistance genes are not very effective. The objective of this project is to investigate if a group of cell surface-localised receptors, called the PERKs, function as damage detectors in plants and test if these receptors can be used to breed broad-spectrum resistance in vegetable crops. Arabidopsis was used as a model plant and tomato as the target crop to study the relevance of PERK receptors.

The aim of this project is to identify novel traits for breeding resistant crops using advanced molecular and microscopic techniques. This research is financed by The Netherlands Organisation for Scientific Research (NWO) and three Dutch breeding companies i.e. KeyGene NV, ENZA Zaden y Rijk Zwaan BV.

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# Melanoidins formation in roasted cocoa beans

From: 2018-2022 - Total budget: € 48,000.-

## (*Theobroma cacao* L.) and their biotransformation by in vitro digestion

*Theobroma cacao* L. fermented and dried seeds are the key raw material for chocolate manufacturing. They are a rich source of polyphenols, these are compounds that confer astringent and bitter sensations and green and fruity flavours. Polyphenols are also responsible for positive health benefits associated with the consumption of cocoa products. Cocoa beans must be roasted in order to reduce the green profiles and to develop brown colour and flavours highly related with desirable characteristics of the final product, in this process the Maillard Reaction takes place and the level and composition of polyphenols are affected.

Melanoidins are high molecular weight polymeric compounds highly responsible for the brown colour obtained after roasting. The falling of polyphenols during thermal treatment and the lack of researches on health properties of cocoa melanoidins has caused consumers to believe that raw cocoa beans are healthier than processed. The objective of this study is to evaluate the physicochemical effects and the volatile profile of cocoa beans roasted by two different techniques, convective oven and fluidised bed drier, and to compare yield, the antioxidant activity and the biotransformation by In vitro digestion of the obtained melanoidins.

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# Solidarity economy:

From: 2017-2021 - Total budget: € 60,000.-

## Realities of Reincorporation FARC-EP ex-insurgents in Colombia

This research aims to describe and analyse the development of a key component of the Colombian Peace Accord—Solidary Economy (SE)—and its implementation through cooperatives of FARC-EP ex-insurgents as the strategy of reincorporation. The development of cooperatives in reincorporation processes is hampered by several obstacles. Some of these (structural constraints, lack of skills of ex-insurgents, difficulties in accessing markets) have been researched in post-conflict situations elsewhere, while little is known about ex-insurgents' strategies and practices addressed to perform cooperatives and productive projects shaping their own reincorporation process, and dealing and contesting institutional and elites' views of reincorporation. Furthermore, remaining conflicts and tensions among the different social sectors in reincorporation processes, are still under-researched.

This project then will throw light on efforts by ex-guerrilla members to shape SE through the establishment of ECOMUN—a network of cooperatives. Theoretically, the project borrows from Santos' Sociology of absences and emergences, and from the political economy of peacebuilding. The researcher (associated to ECOMUN) will take part in the development of educational workshops and media projects. The overall aim of this research is to make an intervention in two distinct bodies of literature: that of Demobilisation, Disarmament and Reintegration (DDR) of ex-fighters, and that of the burgeoning field of SE.

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# Terra Preta de Índio – Amazon Dark Earth

From: 2010-2017 - Total budget: € 15,000,000.-

Anthropogenic soils with high fertility in the Amazon (Terra Preta de Índio; also known as Amazonian Dark Earth) challenge conventional theories on environmental limitation in the Amazonian basin. These improved soils (and their co-evolved crops) offer a major inspiration for (re-)creating soils for sustainable agriculture.

This programme aimed to (1) understand conditions under which Terra Preta originated from biophysical and socio-economic side; (2) understand institutional and policy dimensions related to actual use and potential future use (3) link actual perception and use of these soils for various agricultural purposes, (4) contribute to the creation of soils that allow sustainable and productive agriculture in the Amazon (5) contribute to and maintain the functioning of a network of Latin American Terra Preta researchers; (6) use the conceptualisation of Terra Preta as socially constructed soils to reflect on (and change) actual scientific discourses and practices. Research took place in three countries: Bolivia, Brazil, and Colombia. In Colombia a major research site was near Leticia. Focus in Colombian Amazon was on the interactions between (indigenous) people, soil and manioc. Results indicate that ADE patches are important sites for settling and cultivation of some crop species but not to cassava cultivation. Cassava diversity is not affected by the presence of ADE but is affected by cultural values indigenous people associate to manioc and to maintenance of diversity. Indigenous people contribute to the Amazonian diversity transforming the Amazonian landscape through agriculture, creating ADE and many cassava varieties.

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# Transgressive learning in the age of climate change

From: 2016-2018 - Total budget: € 60,000.-

In the bioculturally diverse, but fragile context of post-accord Colombia, increasing attention is being placed on the need for more inclusive, equitable and relevant education in rural areas to address socio-ecological challenges. Addressing this need is the Koru educational project, which brings together a diversity of participants from afro, peasant and Indigenous communities, sustainability experts, students, and entrepreneurs to explore a commonly defined challenge through online and presential workshops. This year's program involves three communities (the afro community of Las Islas del Rosario, Peasant association of Filandia Quindio, and the Indigenous Kamëntšá in el valle de Sibundoy) living in territories where mainstream tourism is taking its toll on the local population and on the environment.

Through the use of mobile phones and community generated material on an online platform, participants will interact by sharing experiences and diverse knowledges on what we have called 'Tourism of Origin', with the goal of strengthening local culture, promoting learning across communities, and developing action-based projects with the help of seedmoney. This innovative program is to be held in November, 2018, and is the culmination of three years of action-research in the emerging field of transgressive learning, and represents the Colombian case study of the International T-Learning project. This is a collaboration between Rhodes University, Gothenburg University and Wageningen University & Research, whereby the Colombian case study has received special expertise from the WUR Education and Learning Sciences group.

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**More information:**

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# Water Justice Alliance

From: 2009 - ongoing - Total budget projects: € 3,200,000.-

## Equitable, Sustainable, Democratic Water Governance

The Water Justice (Justicia Hídrica) Alliance supports water research, training, education and policies that contribute to an equitable distribution of water, democratic allocation procedures and sustainable use practices.

Led by the Water Resources Management group of Wageningen University & Research, this international alliance of researchers, policy-makers, students, water professionals, smallholders organisations and indigenous grass-roots investigates water conflicts and environmental degradation, trains leaders and young researchers, and triggers policy debate and civil society action on water and food security in Colombia, Latin America, and other continents.

### It combines:

- 1 Transdisciplinary partnerships for research on the dynamics of water injustices;
- 2 Training of a critical, gender-balanced mass of water professionals, grassroots leaders and policy-makers;
- 3 Societal action to engage law- and policy-makers; and support civil society strategies for democratic policies, water conflict resolution, and a more just distribution of water resources.



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# Climate Resilient Cities

From: 2017-2018 - Total budget: € 300,000.-

Towards climate resilience and inclusive urban development in Latin America

Project developed jointly with Instituto Internacional de Medio Ambiente y Desarrollo (IIED), Center for Urban Disaster Risk Reduction and Resilience (CUDRR) as part of the Climate Resilient Cities in Latin America Initiative. The project was funded by the Climate and Development Knowledge Network (CDKN), the International Development Research Center (IDRC) and the Fundación Futuro Latinoamericano (FFLA).

The project was undertaken in cities of Colombia (Dosquebradas), El Salvador and Argentina. The primary objective of the project was to develop and apply a participatory methodology and tools to support climate resilient and inclusive urban development in the rapidly growing small- to medium-sized cities of Latin America. Different trajectories sought to transform the way urban development can be considered, within the context of equitable risk reduction and resilience building.

## **The process consist in three main stages:**

- 1 Stakeholder mapping and interviews,
- 2 Workshop to explore options for climate resilient development,
- 3 Validation of options and policy recommendations.

Knowledge and information exchange took place through the Climate Resilient Cities Initiative platform and workshops as well as a final project workshop with external resilience partners.

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# Nutrients recovery from Waste water

From: 2016 - 2019 - Total budget: € 425,000.-

## More efficient nutrient recovery from wastewater streams with Cyanobacteria

Human urine has high nutrient content; up to 80% of the nitrogen (N) and 40% of the phosphorus (P) that end up in household wastewater. Microalgae have shown to grow in undiluted urine when employing high light supply rates and short light path photo bioreactors, making it possible to recover most of these nutrients in form of biomass. However, the N:P ratio of urine (30-40:1) limited microalgae growth along with the recovery of N.

This limitation can be overcome by cyanobacteria, which accumulate a storage material called Cyanophycin Granule Polypeptide (CGP) when facing P limitation. CGP has potential applications as dispersant and as a raw material for bioplastics production. In this study a CGP accumulation was achieved by different light exposure and the accumulation was induced by starving the biomass on phosphorus. The production of cyanobacterial biomass on source-separated urine could make it possible to fully recover these nutrients, and even transform a significant fraction of them into useful products for industry, like bioplastics, contributing to a circular economy.

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# Forest landscape restoration in Latin America and the Caribbean

From: 2016-2019 – Total budget: € 160,000.-

Deforestation and land degradation are a severe threat in Latin America and the Caribbean which has an impact on global greenhouse gas emissions and results in loss of biodiversity and habitat fragmentation. Forest landscape restoration is a major strategy to improve environmental conditions, to enhance biodiversity, and to increase the provision of ecosystem services. Through different conventions and funding mechanisms (e.g. the Bonn Challenge), many restoration projects have been planned and implemented in recent and upcoming years.

The research produced a database of 154 restoration projects from Initiative 20x20 and others such as the Global Environment Facility (GEF), UNFCCC Clean Development Mechanism (CDM), Forest Investment Program (FIP), including local projects led by local governments, NGOs and research institutes, and mapped them at province/municipality level. Another layer shows the potential forest aboveground biomass accumulation so both together reflect how much forest biomass deforested and degraded areas can accumulate when they would be restored to their potential state.

Comparative analysis of the different restoration initiatives showed it is mainly the donor that determines the nature of the restoration project: project size, goals (e.g. to recover biodiversity, to create local employment, or to promote agro-forestry, etc.), activities (e.g. to implement natural regeneration or to establish commercial forest plantations, etc.) as well as the potential of the areas to accumulate forest biomass and mitigate climate change.

This research was a collaboration between Wageningen University & Research and International Center for Tropical Agriculture (CIAT).

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The mission of Wageningen University & Research (WUR) is *"To explore the potential of nature to improve the quality of life"*.

With roughly 5,000 employees and almost 14,000 students from over 120 countries, among others Colombia, Wageningen University & Research is one of the leading organisations in its domain of healthy food and living environment.

In addition to its renowned fundamental research, Wageningen University & Research has a strong global position as supplier of application-oriented and field based research as well as facilitator of processes of innovation, broker of knowledge and supporter in capacity development.

Capacity building in agro food and green (vocational) education are, worldwide, considered as 'top' in The Netherlands and collaboration in Colombia in this area is appropriate.



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## Colophon

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