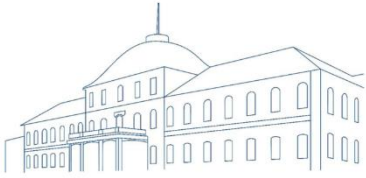




9.º Simposio Brasil-Alemanha  
9. Deutsch-Brasilianisches Symposium



# Desenvolvimento **Sustentável** **Nachhaltige** Entwicklung

**Integrating Systems for Sustainable Development**  
**Linking human and natural components**

September 15 -17, 2019 - University of Hohenheim, Stuttgart

Program and Book of Abstracts



## **Impressum**

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9. Simpósio Brasil-Alemanha  
9. Deutsch-Brasilianisches Symposium



# Desenvolvimento **Sustentável** **Nachhaltige** Entwicklung

**Integrating Systems for Sustainable Development**  
**Linking human and natural components**

**September 15 -17, 2019 - University of Hohenheim, Stuttgart**

## **Program and Book of Abstracts**

### **Organization Committee**

#### **Institute of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute), University of Hohenheim**

Dr. Marcus Giese  
Anna Seidel  
Dr. Marcelo Carauta

#### **Baden-Württemberg Brazil Center of the University of Tübingen**

Dr. Rainer Radtke  
Dr. Fernando Mazo D’Affonseca

## FOREWORD

Dear Participants of the 9<sup>th</sup> German-Brazilian Symposium 2019,

Since 2003, the Brazil-Germany Symposia on Sustainable Development have been alternately held in the state of Baden-Württemberg, Germany and all over Brazil with great success, while also jointly establishing itself as an important bi-national platform for exchange in the sciences, politics and economics. This year, the University of Hohenheim, represented by the Institute of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute), is proud to be the host of this interdisciplinary event linking our two countries in discussing the global challenges and overall progress towards solutions for the sustainability goals.

The theme of the 9<sup>th</sup> Brazil-Germany Symposium is "Integrating Systems for Sustainable Development - Linking Human and Natural Components". Globally, most challenges in achieving the *United Nations Sustainable Development Goals* are interlinked and therefore demand interdisciplinary and cross cutting solution approaches. However, many of these challenges, such as environmental pollution, water scarcity, food security, biodiversity conservation, disease control, provision of clean energy, or climate change are analyzed and managed separately rather than holistically.

# Integrating Systems for Sustainable Development

Linking human and natural components



As a result, the overall objective of the symposium is to improve our understanding of interlinked and complex systems by developing new methods that in a research environment couple human with natural components. This would be a promising approach for sustainable development. The current debate on climate change mitigation, ongoing or even accelerating deforestation, and biodiversity loss reinforces the need to focus and manage human-nature interactions in a more holistic way.

The University of Hohenheim is well-positioned in three socially-relevant research areas that directly relate to the UN sustainability goals, namely bioeconomy, global food security and ecosystems as well as health sciences. Hohenheim also has a strong tradition in cooperating with countries from the Global South, especially in the field of agricultural sciences. The Hans-Ruthenberg-Institute, with specialized working groups and more than 100 scientists, provides profound empirical and theoretical knowledge covering all of the fundamental fields of tropical agriculture, i.e. agroecology, crop and

animal sciences, agricultural engineering as well as agricultural economics and social sciences. One aim is to develop novel integrated strategies to address the challenges related to our changing environment by bringing together natural and social sciences in innovative ways. The overall aim is to use research and education to increase global food security and develop sustainable agricultural systems.

By hosting the 9<sup>th</sup> Germany-Brazil Symposium on Sustainable Development we aim to provide a platform for scientific exchange linking and integrating the inter- and transdisciplinary expertise from different institutions. Events like the German-Brazilian Symposium have the potential to function as a communication hub and make a substantial contribution towards tackling global scientific, environmental, economical and social challenges, with the goal of sustainable development.

This year we shared the responsibilities for the Symposium organization between the Institute of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute) at the University of Hohenheim, the Baden-Württembergischen Brasilien-Zentrum in Tübingen, and Baden-Württemberg International (bw-i). We would like to thank CAPES (Coordination for the Improvement of Higher Education Personnel, Brazil), DWIH-SP (Deutsches Wissenschafts- und Innovationshaus, São Paulo) und bw-i (Baden-Württemberg International), and Andreas Stihl AG & Co. KG for their financial support. The 9<sup>th</sup> Brazil-Germany Symposium on Sustainable Development offers plenary sessions with keynote presentations and thematically focused parallel sessions, film contributions, oral and poster presentations, exhibitions, guided field trips and time for discussion in a pleasant and stimulating atmosphere. The symposium is subdivided into the major topics

- Natural sciences and biodiversity
- System integration for sustainable agriculture and forestry
- Economic, social and environmental challenges

We received many very interesting contributions from which, with the valuable help of scientific experts, we selected a program of more than 150 oral and poster contributions covering a diversity of disciplines and topics. As an added special feature, we decided to integrate the Tropentag conference into the program of the Germany-Brazil Symposium 2019. It is an annual, development-oriented and interdisciplinary conference on research in tropical and subtropical agriculture, natural resource management, and rural development. It seemed only natural that the Tropentag conference with its more than 800 participants from all over the world would ideally complement the topics of the German-Brazilian Symposium, while offering even more opportunities for exchange and cooperation. We hope that participants take the opportunity to visit the Tropentag 2019, held from the 18 to 20 September, at the University of Kassel, Germany. The theme of the Tropentag this year is: "Filling gaps and removing traps for sustainable resources development". Finally, we would like to welcome all participants from the fields of science, politics, economy and society here in Hohenheim and invite them to contribute to the interdisciplinary discussions about current sustainability issues. We hope this event will contribute to the development of new concepts, research questions or partnerships which would then translate into exciting future partnerships in research or educational projects, increasing bi-national cooperation towards sustainable development.

Yours sincerely,

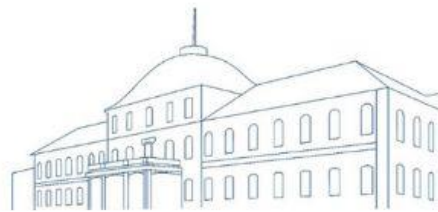


Prof. Dr. Georg Cadisch



Dr. Marcus Giese

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# **Symposium Program**

Brazil-Germany Symposium on Sustainable Development				TROPENTAG (Optional)			
Sep 14	Sep 15	Sep 16	Sep 17	Sep 18	Sep 19	Sep 20	
Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	
Stuttgart			Kassel				
Individual Arrival	<p>1 Hohenheim Palace (10:30 - 16:00)</p> <p>2 City Tour Stuttgart (10:00 - 17:00)</p> <p>3 Wine tour Mausoleum (9:45 - 16:30)</p>	<p>Registration / Welcome Coffee (9:00 - 10:30)</p> <p>Opening Ceremony (10:30 - 11:20)</p> <p>Keynote Speakers (11:20 - 12:30)</p> <p>Lunch (12:30 - 14:00)</p> <p>Session A1 (14:00 - 15:30)</p> <p>Session B1 (14:00 - 15:30)</p> <p>Session C1 (14:00 - 15:30)</p> <p>Session A2 (16:00 - 17:30)</p> <p>Session B2 (16:00 - 17:30)</p> <p>Session C2 (16:00 - 17:30)</p> <p>DAAD Rio Marketplace with Brazilian Rectors (17:30 - 18:30)</p> <p>Poster Session All Topics (17:30 - 18:30)</p> <p>Official Group Photo</p> <p>Social Evening (19:00)</p>	<p>Session A3 (9:00 - 10:30)</p> <p>Coffee Break</p> <p>Session B3 (9:00 - 10:30)</p> <p>Session A4 (11:00 - 12:30)</p> <p>Session B4 (11:00 - 12:30)</p> <p>Lunch (12:30 - 14:00)</p> <p>Binational Programs and Cooperation (14:00 - 15:30)</p> <p>Coffee Break</p> <p>Keynote Speakers &amp; Closing Ceremony (16:00 - 18:00)</p> <p>Conference Dinner (18:30)</p>	<p>Transfer to Kassel</p> <p>Registration TROPENTAG (12:30 - 14:00)</p> <p>Program of the TROPENTAG (14:00 - 15:30)</p> <p>Program of the TROPENTAG (16:00 - 17:30)</p>	<p>Program of the TROPENTAG (9:00 - 10:30)</p> <p>Program of the TROPENTAG (11:00 - 12:30)</p> <p>Program of the TROPENTAG (12:30 - 14:00)</p> <p>Program of the TROPENTAG (14:00 - 15:30)</p> <p>Program of the TROPENTAG (16:00 - 17:30)</p> <p>TROPENTAG Dinner</p>	<p>Program of the TROPENTAG (9:00 - 10:30)</p> <p>Program of the TROPENTAG (11:00 - 12:30)</p> <p>End of TROPENTAG (12:30 - 14:00)</p> <p>End of Symposium (Individual Departure)</p>	

- Audimax
- HS Ö1
- HS Ö2
- Mensa
- Foyer
- TMS
- HS 34
- Hohenheim Palace



## Sep 16, Monday

**09:00 - 10:30**

**- Foyer -**

**Registration / Welcome Coffee**

**10:30 - 11:20**

**- Audimax -**

**Opening Ceremony**

**Prof. Dr. Georg Cadisch** (Director of the Institute of Agricultural Sciences in the Tropics, Hans-Ruthenberg-Institut, University of Hohenheim)

**Prof. Dr. Andreas Pyka** (Vice President for International Affairs of the University of Hohenheim)

**Prof. Dr. Peter Grathwohl** (Vice president for research and innovation, University of Tübingen)

**Dr. Hans-Georg Wolf** (MWK, Ministry of Science, Research and the Arts of the State of Baden-Württemberg)

**Mr. José Mauro da Fonseca Costa Couto** (General Consul of Brazil in Munich)

**Prof. Dr. Heloísa Hollnagel** (CAPES, Coordination for the Improvement of Higher Education Personnel)

**11:20 - 12:30**

**- Audimax -**

**Keynote Speakers**

**Prof. Dr. Eliezer J. Barreiro** (UFRJ, Federal University of Rio de Janeiro)  
*Some results in medicinal chemistry research from Laboratory of Evaluation and Synthesis of Bioactive Substances (LASSBio)* (page 37).

**Prof. Dr. Ulrich A. Glasmacher** (University of Heidelberg)  
*Climate change and human-political response* (page 38).

**Prof. Dr. Folkard Asch** (University of Hohenheim)  
*Savanna Grasslands - awakening the sleeping giant?* (page 39).

**Sep 15, Sunday**

**Pre-Symposium Excursions**

**10:00 - 17:00      Hohenheim Palace**

**09:45 - 16:30      City Tour Stuttgart**

**09:45 - 16:30      Wine Tour Mausoleum**

**Movie Session**

**18:30 - 20:30**

**- HS 34 -**

**"Chão" (Landless) afterwards video conference with the director Camila Freitas**

## Sep 16, Monday

**12:30 - 14:00**

**- Mensa -  
Lunch**

**14:00 - 15:30**

**- Audimax -**

### **Oral Session A1. Managing climate and global system's processes**

Chair Brazil: **Augusto Pereira Filho (USP, University of São Paulo)**

Chair Germany: **Ulrich Glasmacher (University of Heidelberg)**

14:00 - 14:30

**A. Pereira Filho (Chair), F. Vemado, F. A. Reis, L. Giordano, F. M. D'Afonseca**  
*High resolution Quantitative Precipitation Estimation in Brazil* (page 41).

14:30 - 14:45

**J. Matschullat\***, F. Zimmermann, S. von Fromm, L. Medeiros Braga, R. Bezerra de Lima, G. Coimbra Martins (\*Freiberg University of Mining and Technology )  
*Soil respiration (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O) and land use. An Amazon example* (page 42)

14:45 - 15:00

**A. Hampf\***, T. Stella, M. Berg-Mohricke, T. Kawohl, M. Kilian, C. Nendel (\*ZALF, Leibniz Centre for Agricultural Landscape Research)  
*Future yields of double-cropping systems in the Southern Amazon, Brazil, under climate change and technological development* (page 43)

15:00 - 15:15

**B. Kamali\***, T. Stella, M. Berg-Mohricke, C. Nendel (\*ZALF, Leibniz Centre for Agricultural Landscape Research)  
*Multi-objective calibration of vegetation, soil-water dynamics: An application to the grassland ecosystems in Germany* (page 44)

15:15 - 15:30

**C. Bastos\***, R. Galli (\*IFSul, Rio Grande do Sul Federal Institute)  
*DIANA – Greenhouses monitoring and control device* (page 45)

## Sep 16, Monday

**14:00 - 15:30**

**- HS Ö1 -**

### **Oral Session B1. Sustainable food production systems**

Chair Brazil: **Alexandre Berndt (EMBRAPA Southeast Livestock)**

Chair Germany: **Georg Cadisch (University of Hohenheim)**

14:00 - 14:15

**A. Berndt (Chair)**

*How Brazil is shifting its livestock production systems towards sustainability (page 52)*

14:15 - 14:30

**G. Cadisch (Chair)**

*Sustainable food production systems: a need for integrated (modelling) approaches*

14:30 - 14:45

**D. A. Neuwald\***, M. Sellwig, M. Geyer, U. Praeger, F. R. Thewes, A. Brackmann, J. N. Wünsche (\*Competence Centre for Fruit Growing - Lake Constance)

*Less energy is more in apple storage facilities - minimizing fruit losses and maximizing pack-out (page 53)*

14:45 - 15:00

**E. Bernardes\***, R. Machado (\*UNESP, São Paulo State University)

*Comparing two family dairy-farm systems in Brazil (page 54)*

15:00 - 15:15

**H. Vogt\***, R. Melo, F. Antunes, S. Daher, D. Albiero, B. Schmülling (\*UFC, Federal University of Ceara)

*Electric tractor system propelled by solar energy for family farming in the northeast of Brazil (page 55)*

15:15 - 15:30

**L. Monteiro\***, M. Vianna, J. Soares, J. Oliveira, D. Jaiswal, E. Campbell, A. Allee, G. Figueiredo, R. Lamparelli, G. Martha, L. Barioni, L. Lynd, J. Sheehan (\*UNICAMP, State University of Campinas)

*Trends in livestock pasture system intensification in Brazil and Germany (page 56)*

## Sep 16, Monday

**14:00 - 15:30**

**- HS Ö2 -**

### **Oral Session C1. Improving human health**

Chair Brazil: **Lídia Moreira Lima (UFRJ, Federal University of Rio de Janeiro)**

Chair Brazil: **Elizabeth Igne Ferreira (USP, University of São Paulo)**

Chair Germany: **Stefan Laufer (University of Tübingen)**

14:00 - 14:15

**L. M. Lima (Chair)**, M. Júnior, C. Costa, G. Barbosa, D. Amaral, E. Reina, S. Laufer, E. Barreiro

*Studies for the discovery of new antitumor candidates* (page 74)

14:15 - 14:30

**E. I. Ferreira (Chair)**, J. Giarolla

*Drug design and discovery for neglected diseases in Brazil: perspectives of partnership between academia and pharmaceutical industries* (page 75)

14:30 - 14:45

**A. Pfüntzenreuter** (UFSC, Federal University of Santa Catarina)

*Comparison between indicators of age-friendly city projects for sustainable management* (page 76)

14:45 - 15:00

**C. Bastos\***, R. Galli, R. Botelho (\*IFSul, Rio Grande do Sul Federal Institut)

*SOFIA - Optical system of operation and medical analyses* (page 77)

15:00 - 15:15

**M. Goettert\***, T. Schneider, S. Laufer (\*UNIVATES, Taquari Valley University)

*Dual JNK and p38 MAPK inhibitor strongly inhibit hepatocellular carcinoma viability and proliferation* (page 78)

15:15 - 15:30

**F. Morrone\***, F. Cruz, T. Pereira, S. Altenhofen, K. Costa, M. Bogo, C. Bonan (\*PUCRS, Pontifical Catholic University of Rio Grande do Sul)

*Evaluation of ionizing radiation toxicity and its influence on the adenosinergic system in zebrafish* (page 79)

## Sep 16, Monday

**15:30 - 16:00**

**- Foyer -  
Coffe Break**

**16:00 - 17:30**

**- Audimax -**

### **Oral Session A2. Biodiversity and ecosystems services**

Chair Brazil: **Ingo Isernhagen (EMBRAPA)**

Chair Germany: **Peter Rosenkranz (LAB Hohenheim, State Institute for Bee Science)**

16:00 - 16:15

#### **I. Isernhagem (Chair)**

*Gain of scale in the restoration of ecosystems in Brazil: can we handle it? (page 84)*

16:15 - 16:30

**C. Reiber\***, M. Siemann, Z. Valle, M Chagunda (\*University of Hohenheim)

*Integrating livestock production and rangeland conservation for a sustainable use of the Caatinga ecosystem (page 85)*

16:30 - 16:45

F. Macedo, **L. Valks\***, J. Boele (\*Black Jaguar Foundation)

*Large scale ecosystem restoration: The Araguaia biodiversity corridor by the Black Jaguar Foundation (page 86)*

16:45 - 17:00

**J. Matschullat\***, R. Lima, J. Enzweiler, M. Schneider (\*Freiberg University of Mining and Technology)

*Pedogeochemistry of Amazonas terra firme soil – 66 elements (page 87)*

17:11 - 17:15

**M. Siegmund-Schultze\***, A. Cierjacks, J. Almeida-Cortez (\*Technical University of Berlin)

*Towards land degradation neutrality in vulnerable ecosystems: an inter- and transdisciplinary approach in the Brazilian Caatinga (page 88)*

17:15 - 17:30

**D. Oliveira\***, J. Almeida-Cortez, A. Cierjacks, B. Rudolph (\*UFPE, Federal University of Pernambuco)

*Impacts of recent land use on the fine-scale genetic structure of the endemic tree *Spondias tuberosa* Arr. (page 89)*

**Sep 16, Monday**

**16:00 - 17:30**

**- HS Ö1 -**

**Oral Session B2. Forestry systems - renewable resources for growing demands**

Chair Brazil: **Saulo Guerra (UNESP, São Paulo State University)**

Chair Germany: **Bastian Kaiser (University of Applied Forest Sciences  
Rottenburg)**

16:00 - 16:30

**S. Guerra (Chair)**

*Bamboo: an alternative source of biomass for bioenergy (page 95)*

16:30 - 16:45

**A. Silva** (Wuppertal Institute for Climate)

*Applying circular economy principles in forest landscape restoration (FLR) to design out deforestation in Brazilian biomes (page 96)*

16:45 - 17:00

**L. Ferreira\***, F. Soglio (\*UFRGS, Federal University of Rio Grande do Sul)

*Mapping of agroforestry systems in Rio Grande do Sul, Brazil (page 97)*

17:00 - 17:15

**R. von Eye\***, F. von Eye (\*UFRGS, Federal University of Rio Grande do Sul)

*Indigenous schools infrastructure in the Brazilian tropical forests (page 98)*

17:15 - 17:30

**E. Kupfer** (Martius-Staden Institute, São Paulo)

*Deforestation in the Amazon area (page 99)*

## Sep 16, Monday

16:00 - 17:30

- HS Ö2 -

### Oral Session C2. Ethics for sustainable global change and healthy environment

Chair Germany: **Thomas Potthast (University of Tübingen)**

16:00 - 16:15

**T. Potthast (Chair)**

*On the values of biodiversity and sustainable development in the age of moral pluralism and extinction – ethical considerations (page 101)*

16:15 - 16:30

N. Richetti, **A. Pfützenreuter\*** (\*UFSC, Federal University of Santa Catarina)

*Study application of the LEED O+M certification in a Brazilian Airport Terminal (page 102)*

16:30 - 16:45

**A. Miola** (Universität zu Köln)

*Circular economy and the fashion industry: the path towards sustainability? (page 103)*

16:45 - 17:00

**S. Springer\***, B. Peregovich, M. Schmidt (\*Pforzheim University)

*Socio-economic structures of the artisanal small-scale mining sector of gold in the Amazonian Rainforest of Brazil (page 104)*

17:00 - 17:15

**E. Araripe\***, V. Zuin (\*UFSCar, Federal University of São Carlos)

*German methodology, Brazilian practice: challenges implementing Plant-for-the-Planet in Brazil for teaching climate change (page 105)*

17:15 - 17:30

**S. Otto** (University of Hohenheim)

*Costs and motivation – the two psychological determinants of the Water-Energy-Food-Nexus (page 106)*



**Sep 16, Monday**

**17:00 - 18:30**

**- Foyer -**

**Poster session A. Natural sciences and biodiversity**

L. Licks, C. **Kunzler\***, R. Iglesias, C. Luís Frankenberg (\*PUCRS, Pontifícia Universidade Católica do Rio Grande do Sul)

*Project of microcosm system in saturated and unsaturated soil columns for CO<sub>2</sub> leakage biomonitoring (page 46)*

A. Severo, J. Damasceno, **K. Madruga\***, C. Pich, L. Michaelis (\*UFSC, Federal University of Santa Catarina)

*The contribution of university to support the plant for the planet movement (page 47)*

C. Ribas, R. A. Pollo, S. Campos, **M. Leme\***, F. Souza, R. Parmeggiani (\*UNESP, São Paulo State University)

*Forest biomass and areas of permanent preservation in familiar rural properties: the Brazilian new forestry law (NLF) (page 48)*

**M. Leme\***, M. Almeida, O. Almeida, F. Souza, R. Souza, S. Campos, L. Gomes (\*UNESP, São Paulo State University)

*Preliminary results of artificial intelligence applied to botanical identification means of images aiming at sustainability (page 49)*

**R. Melo\***, E. Melo, R. Melo, A. Giglioli, J. Menezes (\*UFRGS, Federal University of Rio Grande do Sul)

*The urban planning importance at the heat island bubbles analyzes in Passo Fundo – RS (page 50)*

**B. Díaz\***, M. Zucchi, L. Berton, C. da Costa, J. Azevedo, C. Colombo (\*UNICAMP, University of Campinas)

*Conserving genetic diversity in progenies of open pollination of macaúba for commercial plantations and breeding (page 93)*

**F. Souza\***; M. Leme; T. Lobo; G. Costa; O. Fonseca; S. Campos; V. Rodrigues; A. Pollo (\*UNESP, São Paulo State University)

*Evaluation of organomineral fertilization in the culture of sugar cane (page 72)*

**T. Miranda\***, A. Junginger, B. Harter-Marques, N. Cardoso, W. Engels, R. Radtke, M. Ebner (\*University of Tübingen)

*Flowering pattern of epiphytic orchids in rainforests of the Planalto das Araucárias in Southern Brazil (page 90)*

**V. Da Riva Carvalho\***, R. Radtke, M. A. Neves, S. Sourell (\*Cristalino Ecological Foundation)

*Responsible socioeconomic development in tune with nature: Exploring and embracing the biological diversity of Southern Amazonia (page 91)*

**V. Da Riva Carvalho\***, S. Wiedmann, R. Radtke (\*Cristalino Ecological Foundation)

*Conservation of Private Reserves in Brazil: the example of the Cristalino Lodge in the Amazon (page 92)*

R. A. Pollo, L. Ribas, S. Campos, **M. Leme\***, F. Souza, V. Rodrigues (\*UNESP, São Paulo State University)

*Environmental degradation of water resources under sugar cane and pasture* (page 57)

**O. Silva\***, L. Pinheiro, D. Mendes, M. Hammes, F. Moraes, R. Galli (\*IFSul, Rio Grande do Sul Federal Institute)

*Study of techniques for measuring and controlling water parameters* (page 58)

R. Roedel, E. Rodrigues, **M. Sousa\***, J. Werlang, E. Fontoura (\*Converge, Sao Paulo, Brazil)

*Application of mathematical model to promote sustainable groundwater use in highly populated area in Bahia, Brazil* (page 59)

**D. Gastmans\***, V. Santos, L. Batista, L. Santarosa, S. Balbin (\*UNESP, São Paulo State University)

*Controls of groundwater recharge by regional climatic features in Southeastern Brazil revealed using stable isotopes* (page 60)

**F. Zebner\***, S. Herrmann (\*Leibniz University Hannover)

*Planning, participation and sustainable water use to produce electricity in rural communities in Brazil* (page 118)

**F. Ejaz\***, T. Wöhling, N. Wolfgang (\*University of Stuttgart)

*Development of a lumped hydrological model for reasonable, long - term predictions of groundwater storage* (page 119)

S. A. D., Firoozabadi, **S. M. Farahani\*** (\*Shahed University)

*Surfactant seed coating; beneficial or Toxic* (page 120)

**J. Viana\***, O. Reinhold, R. Alt (\*University of Leipzig)

*Smart services assessment for energy communities* (page 143)

**R. Muzzi\***, J. C. Santos, P. Suegama, R. C. Andrade (\*UFGD, Federal University of Grande Dourados)

*Production and characterization of biochar from macauba endocarp (*Acrocomia aculeata*)* (page 144)

**C. Schmitt\***, R. Moreira, R. Neves, D. Richter, A. Funke, Axel, K. Raffelt, J.D. Grunwaldt, N. Dahmen (\*Karlsruhe Institute of Technology)

*Fast pyrolysis of sugarcane biomass and hydrotreatment of pyrolysis oil for production of renewable fuels and chemicals* (page 145)

**D. Moreira\***, P. Chaves, F. Rodrigues, T. Arruda, M. Shanz, M. Maier, N. Ricardo (\*UFC, Federal University of Ceará)

*Synthesis of new esters from moringa oil (*Moringa oleifera*) with lubricant potential* (page 146)

**M. Wormann\***, E. Martin (University of Tübingen)

*Synthesis of CO<sub>2</sub> - neutral fuels and allyl alcohol from vegetable oil* (page 147)

**D. Carvalho\***, J. Grimoni (\*USP, University of São Paulo)

*Groundwater supply: impacts on the Brazilian electricity system and assessment of scenarios for sustainable development* (page 148)

**L. Souza\***, C. Petzhold, E. Francisquetti (\*UFRGS, Federal University of Rio Grande do Sul)

*PVC plasticizer from renewable sources* (page 149)

M. Ishiguro, H. Marçal, E. Watzko, **K. Madruga\*** (\*UFSC, Federal University of Santa Catarina)  
*Energy efficiency automation systems in the headquarter of the Technology without Borders Association in Brazil* (page 150)

V. Savi, R. Geremias, **K. Madruga\***, L. Janke (\*UFSC, Federal University of Santa Catarina)  
*Techno-economic and environmental assessment of the electric energy generation potential of biogas produced at Santa Luzia Wastewater Treatment Plant (Criciúma/Brazil)* (page 151)

**S. Guerra\***, F. Castanho, E. Leonello, H. Eufrade-Junior, Mauro Schumacher (\*UNESP, São Paulo State University)  
*Fuel properties of young bamboo and eucalypt plantations* (page 152)

**P. Casanova\***, K. Solís (\*University of Costa Rica)  
*Characterization of agro-residues for bioenergy production in Costa Rica* (page 153)

G. C. Vergara, **C. Brito\***, F. Fernandes, M. Silva, S. Guerra (\*UNESP, São Paulo State University)  
*Growth, productivity and gas exchange of *Bambusa vulgaris* Schrad. ex J.C. Wendl. on short rotation planting* (page 154)

## Sep 16, Monday

**17:00 - 18:30**

**- Foyer**

### **Poster session B. System integration for sustainable agriculture and forestry**

S. Glatzle, **M. Giese\***, F. Asch, R. Giolo (\*University of Hohenheim)  
*Effects of shading and soil moisture on *Brachiaria brizantha* biomass in an integrated crop-livestock-forestry system* (page 61)

**E. Coutinho\***, G. Silva (IFsul, Rio Grande do Sul Federal Institute)  
*Composting vegetable residues of the preparation of meals in school of basic education of Arroio Grande RS, Brazil* (page 62)

**M.C. Guth\***, R. Arruda, K.C. Madruga (\*UFSC, Federal University of Santa Catarina)  
*Analysis of the opportunities for integrating agroenergy and agroecology in the microregion of Araranguá / SC / Brazil* (page 63)

O. Fonseca, H. Filho, **M. Leme\***, F. Souza, S. Campos, V. A. Rodrigues, M. Almeida (\*São Paulo State University)  
*Automation of a mini domestic stove by arduino microcontroller* (page 64)

M. Santos, **T. Hubert-Ribeiro\***, C. Bergmann (\*UFRGS, Federal University of Rio Grande do Sul)  
*Obtaining chitin with environmental, economic and social sustainability* (page 65)

**C. Miranda\***, C. Cavalcanti, C. Cereijo, P. Abdelnur, P. Costa (\*EMBRAPA, Brazilian Agricultural Research Corporation)  
*Diversity of phytohormones within microalgae* (page 66)

**C. Podkowa\***, G. Gouveia, C. Hintze (\*Unioeste, Western Paraná State University)  
*Comparison of herb species in ecological production using composttea* (page 67)

**M. M. Ribeiro\***, C. Lopes, G. Albuquerque, P. Perna. R. Olegario (\*UFPR, Federal University of Paraná)  
*The Situation of Agrochemicals in Brazil* (page 68)

**M. Ribeiro\***, M. Batista (\*UFPR, Federal University of Parana)  
*Occurrence of root mealybug *Dysmicoccus* sp.(Hemiptera: Pseudococcidae) and other soil organisms in the culture of Rhubarb (*Rheum* spp.) in Mandirituba, Paraná, Brazil* (page 69)

**A. Seidel\*** (\*University of Hohenheim)  
*Sustainable intensification and diversification: A case study of a colonist farm in Brazilian Amazonia* (page 70)

**A. Barrio\***, I. Gonzalez, W. Benitez, D. Wassner (\*UBA, Faculty of Agronomy)  
*Work of linkage with an agrotechnical school to create opportunities for rural development from the cultivation of *Acrocomia totai** (page 71)

**F. Souza\***, T. Otani, M. Leme, R. Oliveira, S. Campos, V. A. Rodrigues (\*UNESP, São Paulo State University)  
*Financial analysis of the production of shimeji mushroom (*Pleurotus sajor*) in southeastern Brazil* (page 128)

R. Oliveira, **F. Souza\***, T. Otani, M. Leme, S. Campos, V. Rodrigues (\*UNESP, São Paulo State University)  
*Evaluation of shimeji mushroom production process (*Pleutorus sajor*): a study case from Brazil* (page 129)

**M. Hinderer\***, C. Meyer, S. Motoike, G. Cadisch, T. Hilger, Thomas (\*University of Hohenheim)  
*Sole vs. mixed cropping – what are suitable cropping options for macaw palm?* (page 130)

## Sep 16, Monday

**17:00 - 18:30**

**- Foyer**

### Poster session C. Economic, social and environmental challenges

**C. Braga\***, R. Klaus (\*Technical University of Berlin)  
*Relation between work place environment, well-being and productivity* (page 80)

C. Lopes, G. Albuquerque, **M. Ribeiro\***, P. Perna, R. Olegário (\*UFPR, Federal University of Paraná)  
*The pesticides present in the food of Brazilians* (page 81)

**A. R. Teixeira Netto\***, J. Hurst, M. Löscher, K.-U. Bartz-Schmidt, S. Schnichels (\*University of Tübingen)  
*Development of dry eye models to test a new treatment option for dry eye syndrome* (page 82)

- N. Monteiro\***, E. Silva, J. Neto (\*UFPI, Federal University of Piauí)  
*Possibilities for sustainable development in crushed stone mining* (page 107)
- H. C. Busch** (University of Cologne)  
*The potential of frugal innovation for sustainability transitions in Brazil* (page 108)
- M. Albuquerque\***, E. Edvânia (\*UFRPE, Federal Rural University of Pernambuco)  
*Interactions between nature and society: the environment from a scholar geography perspective* (page 109)
- T. Squeff\***, V. Magri, J. Nunes (\*UFU, Federal University of Uberlândia)  
*Global compact of migration: an important tool of guaranteeing migrants rights and promoting sustainable development* (page 135)
- T. Squeff\***, E. Magalhães, A. Canhameiro (\*UFU, Federal University of Uberlândia)  
*Are refugees a threat? The demystification of the impact caused by immigrants within countries' of destination* (page 137)
- M. Torres\***, G. Letcooviski, V. Boulomytis, C. D. Alves (\*IFSP, Federal Institute of Science, Education and Technology of São Paulo)  
*Cycling cities and sustainable urban development: challenges for Caraguatatuba, SP, Brazil* (page 168)
- E. Calgaro, M. Araújo, R. Melo, E. Melo, **R. Melo\*** (\*IMED, Meridional Faculty)  
*Cycle infrastructure and the impacts over the bicycle use in - Passo Fundo* (page 169)
- F. Benjamin\***, B. Peregovich, M. Schmidt (\*Pforzheim University)  
*Life cycle inventories of small-scale gold mining in the Amazonian rainforest in Brazil* (page 170)
- F. Mattos\***, E. Gresse, L.F. Beitem (Instituto Terroá/Universität Hamburg)  
*Monitoring and evaluating sustainable territorial development in the Brazilian Amazon: the experience of Instituto Terroá* (page 171)
- A. Giglioli, T. Rossetto, E. Melo, **R. Melo\***, R. Melo (\*IMED, Meridional Faculty)  
*The green infrastructure relation on the campus I of the university of Passo Fundo with the quality of learning* (page 172)
- C. Flores\***, A. Ferreira (\*PUCRS, Pontifical Catholic University of Rio Grande do Sul)  
*Biodiversity preservation and the conflict between criminal justice and traditional people: Bagre fishing in southern Brazil* (page 173)

**Sep 16, Monday**

**17:00 - 18:30**

**- Foyer -**

**Marketplace with 11 Brazilian Rectors  
(organized by DAAD - Rio)**

**Martina Schulze and Jochen Hellmann** (DAAD - Rio)

**Dercio Luiz Reis** (UFAM, Federal University of Amazon)

**Cleinaldo de Almeida Costa** (UEA, State University of Amazon)

**Emmanuel Zagury Tourinho** (UFPA, Federal University of Pará)

**Luís Eduardo Bovolato** (UFT, Federal University of Tocantins)

**Ari Miguel Teixeira Ott** (UNIR, Federal University of Rondônia)

**Marcel do Nascimento Botelho** (UFRA, Federal Rural University of Amazon)

**Hugo Alex Carneiro Diniz** (UFOPA, Federal University of Western Pará)

**Margarida de Aquino Cunha** (UFAC, Federal University of Acre)

**Catia Monteiro Wankler** (UFRR, Federal University of Roraima)

**Leonardo Teixeira Dall'Agnol** (UFMA, Federal University of Maranhão)

**Antonia Maria Ramos Franco Pereira** (INPA, National Institute of Amazon Researches)

**18:30 - 19:00**

**- Hohenheim Palace -  
Official Group Photo**

**19:00**

**- TMS -  
Social Evening**

## Sep 17, Tuesday

**09:00 - 10:45**

**- Audimax -**

### **Oral Session A3. Water as a resource for sustainable development**

Chair Brazil: **Edson Wendland (USP, University of São Paulo)**

Chair Germany: **Marianna Siegmund-Schultze (Berlin Institute of Technology)**

09:00 - 09:15

#### **E. Wendland (Chair)**

*Water availability and quality threats in a Guarani Aquifer System outcrop zone (page 111)*

09:15 - 09:30

#### **M. Siegmund-Schultze (Chair)**

*Water as a resource for sustainable development in Northeast-Brazil: insights from the INNOVATE project (page 112)*

09:30 - 09:45

**F. M. D'Afonseca\***, H. Rügner, M. Finkel, K. Osenbrück, C. E. Duffy, O. Cirpka  
(\*University of Tübingen)

*Sustainable limestone quarrying in water protection areas (page 113)*

09:45 - 10:00

**E. M. Neves** (UFRJ, Federal University of Rio de Janeiro)

*Water governance, water security and sustainability in Brazil (page 114)*

10:00 - 10:15

D. Neuffer, **N. Otto\***, U. Menzel, K. Amaral, L. Dufner, T. Selvam, H. Santos  
(\*Universität Stuttgart)

*Operation and adaption of a small self-sufficient wastewater treatment plant to the tropical regions of Brazil (page 115)*

10:15 - 10:30

**C. R. Oliveira\***, E. A. T. Marques, A.C. Silva, M. C. Sobral (\*UFPE, Federal University of Pernambuco)

*Impacts of the critical climatic periods on water multiple uses in the Rio Pajeú watershed, Brazilian semiarid (page 116)*

10:30 - 10:45

**P. Grathwohl\***, E. Petrova, E. Kortunov, M. Finkel (\*University of Tübingen)

*Turnover of pollutants at the catchment scale (page 117)*

## Sep 17, Tuesday

**09:00 - 10:30**  
**- HS Ö1 -**

### **Oral Session B3. Minor crops and their importance for bioeconomy**

Chair Brazil: **Carlos Augusto Colombo (IAC, Agronomic Institute of Campinas)**

Chair Germany: **Thomas Hilger (University of Hohenheim)**

09:00 - 09:15

**C. Colombo (Chair)**, L. Berton, W. Borges, R. Soares, B. Hernandez, J. Azevedo  
*Silvopastoral system with macauba palm: a bioeconomic option for south central Brazil*  
(page 122)

09:15 - 09:30

**T. Hilger (Chair)**

*Plant genetic resource and bioeconomy: Are we moving in the right direction?* (page 121)

09:30 - 09:45

D. Madeira, K. Kuki, A. Castro, **S. Motoike\***, T. Hilger, G. Cadisch (\*UFV, Federal University of Viçosa)  
*Carotenoids variability in the Brazilian germplasm collection of macauba palm, Acrocomia sp.* (page 123)

09:45 - 10:00

P. Pires, C. Aldara, A. Cardoso, **S. Favaro\***, M. A. Conejero (\*UFF, Fluminense Federal University)  
*Competitiveness of two Macauba productive chains in Brazil* (page 125)

10:00 - 10:15

**D. Massuela\***, C. Piatti (University of Hohenheim)

*Hemp as a multifunctional alternative: the case of the Quilombola communities of the Brazilian Sertão* (page 126)

10:15 - 10:30

A. Goez, **S. Marinho\*** (\*UFRGS, Rio Grande do Sul Federal University)

*Interaction between the family farm's livelihood production and socio economic sustainability, a study case in Brazil* (page 127)



**Sep 17, Tuesday**

**09:00 - 10:30**

**- HS Ö2 -**

**Oral Session C3. Migration and communication (Socio-dynamics)**

Chair: **Diego Amaral (University of Tübingen)**

09:00 - 09:30

**D. Amaral (Chair)**

*Necropolitics of migration: thesis on the darker side of globalization* (page 132)

09:30 - 09:50

**A. Miola** (Universität zu Köln)

*Forced migration and climate change: a new refugee category?* (page 133)

09:50 - 10:10

**A. Torfa\***, S. Almohammad, R. Birner (\*Social and Institutional Change in Agricultural Development)

*Determinants of Migration and Influential Actors and Factors behind the Destination Choice: Afghan and Syrian Refugees in Stuttgart* (page 134)

10:10 - 10:30

**T. Squeff\***, B. Patriota (\*Federal University of Uberlândia)

*Brazilian reception of Venezuelan Refugees: a de facto implementation of the Global Compact for Migration?* (page 136)

## Sep 17, Tuesday

**10:30 - 11:00**

**- Foyer -  
Coffe Break**

**11:00 - 12:30**

**- Audimax -**

### **Oral Session A4. Renewable energy**

Chair Brazil: **Alcides Lopes Leão (UNESP, São Paulo State University)**

Chair Germany: **Witold-Roger Pogonietz (KIT, Karlsruhe Institute of Technology)**

11:00 - 11:30

**A. Leão (Chair)**, I. Cesarino, D. Rosa

*The circular economy under the biomass cascade approach (page 139)*

11:30 - 11:50

**I. Santos** (Institute for Advanced Sustainability Studies)

*The resource nexus and biofuels: a comparison of Brazil and German case studies (page 140)*

11:50 - 12:10

**D. François\***, W. R. Pogonietz, S. Biswas, C. Miller, M. J Parmentier (\*Karlsruhe Institute of Technology)

*Achieving multiple Sustainable Development Goals in rural communities through participatory energy projects based on renewables (page 141)*

12:10 - 12:30

**P. Silveira** (University of Bremen)

*Strategic Environmental Assessment (SEA) for renewable energies: Brazil and Germany compared (page 142)*

## Sep 17, Tuesday

**11:00 - 12:30**

**- HS Ö1 -**

### **Oral Session B4. Combining biophysical and socio-economic models**

Chair Brazil: **Marcelo Carauta (University of Hohenheim)**

Chair Germany: **Claas Nendel (ZALF, Leibniz Centre for Agricultural Landscape Research)**

11:00 - 11:15

**M. Carauta (Chair)**, A. Hampf, A. Libera, T. Berger

*Combining agent-based models and crop growth models to simulate farmers decision-making and policy interventions (page 156)*

11:15 - 11:30

**C. Nendel (Chair)**

*Economic and ecological assessment of crop rotations and management strategies using simulation models (page 157)*

11:30 - 11:45

**A. Pyka\***, K. Bogner, S. Urmetzer (\*University of Hohenheim)

*Productivity slowdown or paradigm shift? Schumpeter meets Georgescu-Roegen (page 158)*

11:45 - 12:00

L. Caspersen, R. I. Lima Filho, **G. Heisenberg\***, S. Wöhrle (\*Technische Hochschule Köln)

*Combining socio-economic and remote sensing data for food insecurity prediction using neural networks (page 159)*

12:00 - 12:15

**K. Carauta\***, M. Carauta, A. Hampf, T. Berger (\*University of Hohenheim)

*Assessing climate variability and simulated crop yields of double-cropping systems in Mato Grosso, Brazil (page 160)*

12:15 - 12:30

**J. Parussis\***, M. Carauta, A. Hampf (\*University of Hohenheim)

*Effect of climate change on the yields of rein-fed agricultural systems in Mato Grosso (page 161)*

**Sep 17, Tuesday**

**11:00 - 12:30**

**- HS Ö2 -**

**Oral Session C4. Human environment interaction**

Chair Brazil: **Juliana Gardenalli de Freitas (UNIFESP, Federal University of São Paulo)**

Chair Brazil: **Bernhard Gregor Peregovich (UFOPA - Federal University of Western Pará - Santarém)**

11:00 - 11:25

**J. Freitas (Chair)**

*Sustainable human environment interaction: time for action (page 163)*

11:25 - 11:45

**B. Peregovich (Chair)**

*A critical review of ASSM and industrial mining in the Amazon rain forest over Time (page 164)*

11:45 - 12:00

**R. Chow\***, H. Wu, J. Bennett, J Dugge, T. Wöhling, W. Nowak (\*University of Stuttgart)

*Surface water-groundwater exchange: nature's water purifier (page 165)*

12:00 - 12:15

**A. Pilon** (USP, University of São Paulo)

*A global voice for survival: an ecosystemic approach for advocacy, communication, public policies, research and teaching programmes (page 166)*

12:15 - 12:30

**J. Matschullat\***, S. von Fromm, R. Lima, G. Martins (\*Freiberg University of Mining and Technology)

*Carbon (Ct, Corg), nitrogen (Nt) and sulfur (St) dynamics in Amazonas soils – some surprises (page 167)*

**Sep 17, Tuesday**

**12:30 - 14:00**

**- Mensa - Lunch**

**14:00 - 15:30**

**- Audimax -**

### **Binational Programs and Cooperation**

**Heloísa Hollnagel and Pablo Gabriel Ferreira** (CAPES, Coordination for the Improvement of Higher Education Personnel)

**Dietrich Halm** (DFG, Deutsche Forschungsgemeinschaft, Bonn)

**Márcio Weichert** (DWIH-SP, German Centre for Research and Innovation São Paulo)

**Sonja Dube** (bw-i, Baden-Württemberg International)

**Jochen Hellmann** (DAAD - Rio, German Academic Exchange Service)

**Maria do Carmo Martins Sobral** (Rebralint, Brazil-Germany Network for Higher Education Internationalization)

**15:30 - 16:00**

**- Foyer - Coffe Break**

**16:00 - 18:00**

**- Audimax -**

### **Keynote Speakers & Closing Ceremony**

Moderation:

**Dr. Marcus Giese** (Institute of Agricultural Sciences in the Tropics, University of Hohenheim)

**Dr. Rainer Radtke** (Baden-Württembergisches Brasilien-Zentrum of the University of Tübingen)

Keynotes:

**Vitória Da Riva Carvalho** (Ecological Foundation Cristalino, Alta Floresta)  
*Conservation of private reserves in BRAZIL: the example of the Cristalino lodge in the Amazon*

**Eckhard E. Kupfer** (Martius-Staden Institute, São Paulo)  
*200 Years the voyage of Spix and Martius through Brazil* (page 176)

**Prof. Dr. Josef Settele** (Helmholtz-Centre for Environmental Research - UFZ)  
*The Global Assessment of IPBES (Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services) – towards Integrating Systems for Sustainable Development* (page 177)

**18:00**

**- TMS -**

**Conference Dinner**



## **Pre-Symposium Excursions**

## Hohenheim Palace



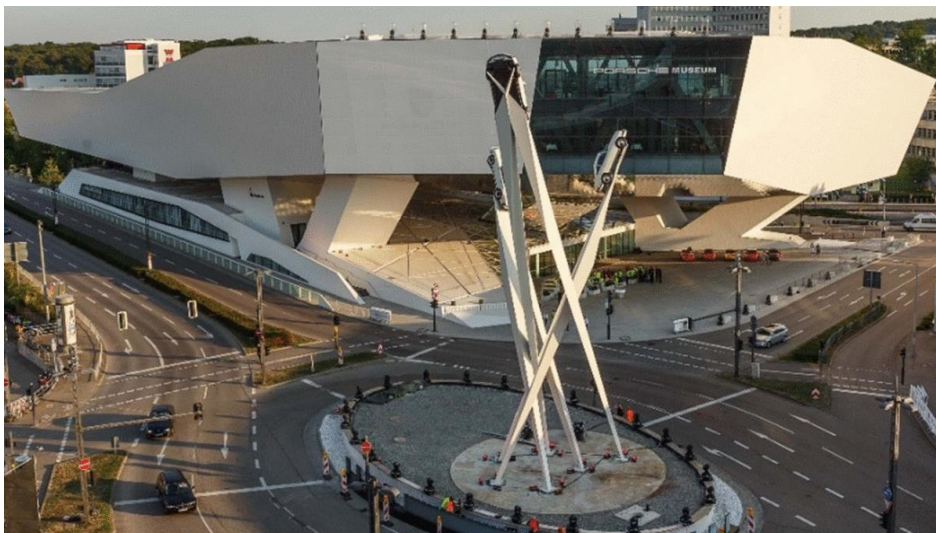
You will visit the Hohenheim Gardens with buildings from the ducal period and modern works of art. There, you will observe giant trees over 200 years old, rare Magnolia trees, a promenade lined with poplars. Research and teaching at the University of Hohenheim is supported by the Hohenheim Gardens. You will enjoy the Botanical Garden leading through various aspects of vegetation history, the Exotic Garden constructed by Duke Carl Eugen and Franziska von Hohenheim, and the Landscape Garden offering a chance for relaxation and experiencing nature. The new greenhouse houses more than 1,800 plant species. The lunch will take place at the Wirtshaus Garbe, next to the University of Hohenheim, a traditional Swabian cuisine. After lunch you will visit the German Agricultural Museum at the University of Hohenheim, which shows the development from simple agricultural tools up to the most modern agricultural technology. Then, you will enjoy the Hohenheim Palace, the former summer residence of Herzog Carl Eugen von Württemberg. The current form of the Hohenheim Palace was built on the model of the Palace of Versailles in France.



## City Tour Stuttgart



You will visit the center of the city Stuttgart, the capital and largest city of the German state of Baden-Württemberg. Many historic buildings were reconstructed after the Second World War. You will visit the Palace Square, the Koenigstrasse - the longest pedestrianized street in Germany, and other unique places in the city center. The lunch will take place at the Carls Brauhaus, next to the Palace Square, a traditional brewery with the local Swabian cuisine. Following this, you will visit the Porsche Museum. The dynamic nature of the Porsche brand is reflected in the architecture of the museum. You will have also the opportunity to enjoy a special exhibition called "50 Years of Porsche 917 – Colours of Speed" in the Porsche Museum.





## Wine Tour Mausoleum



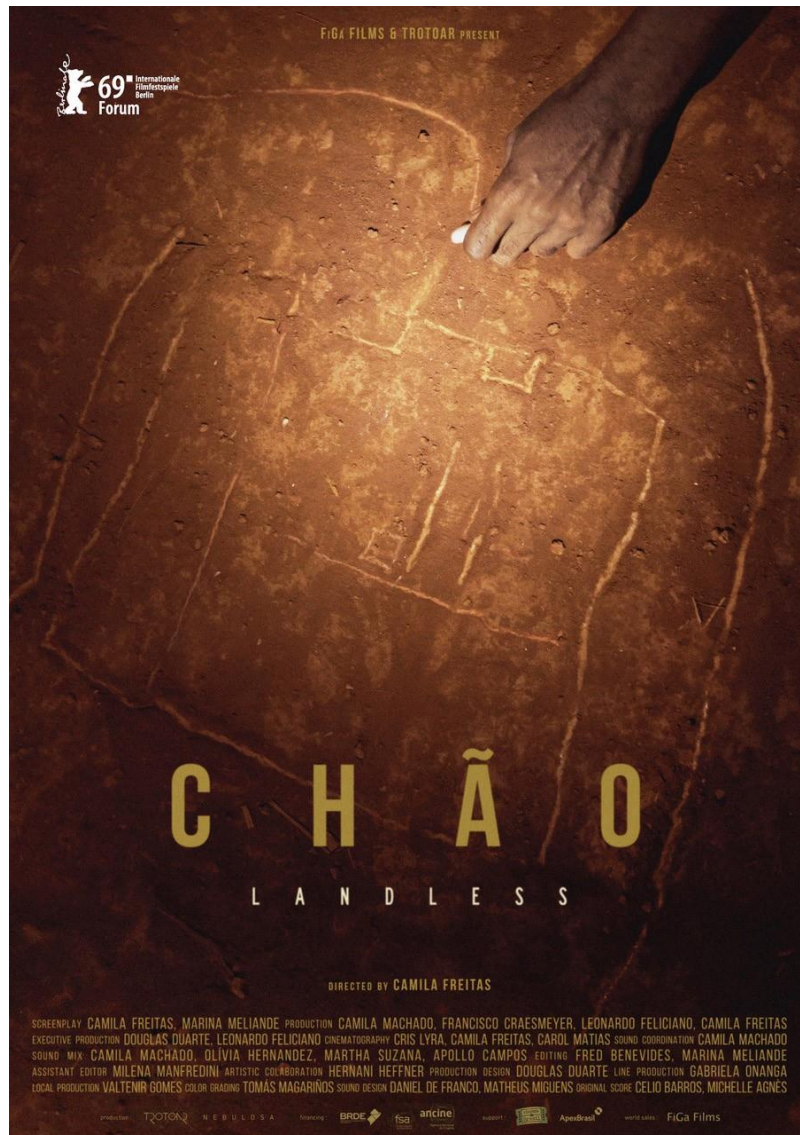
You will visit the Württemberg Mausoleum standing on the peak of the Württemberg Hill in the middle of the vineyards along the river Neckar. Its circular structure made from local sandstone and its domed roof are visible from a distance. You will walk in the vineyards, enjoying an astonishing view of the city of Stuttgart. The lunch will take place at the Alte Kelter, next to the vineyards, a cosy family-run restaurant with traditional Swabian cuisine. It is known for its Maultasche, a pasta dough that encloses a filling. Following this, you will visit the Wilhelm Kern GmbH, a local winery run by the Kern family since 1903. You will visit their winery with a guided tour in their facilities and enjoy a wine tasting at the end.





## **Movie Session**

**"Chão" (Landless)**  
video conference with **the director Camila Freitas**



Over a period of four years, Camila Freitas documented the lives of a group of landless workers in the Brazilian state of Goiás. Since 2015, the workers have occupied a portion of a factory site and demanded land reform. *Chão* provides insights into the group's everyday routine, which is divided up between tilling the land, political activism and talk of what a better future might look like. The film thus delves into the microstructures of local political action while also demonstrating just how dependent the Landless Workers Movement is on Brazilian



Abstracts  
**Keynote Speakers**  
**- Opening Ceremony -**

# Some results in medicinal chemistry research from Laboratory of Evaluation and Synthesis of Bioactive Substances (LASSBio).

Barreiro, Eliezer J. <sup>1,\*</sup>; Lima, Lídia M.<sup>1</sup>

<sup>1</sup>LASSBio, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil

\*Corresponding author. E-mail: ejbarreiro@ccsdecania.ufrj.br

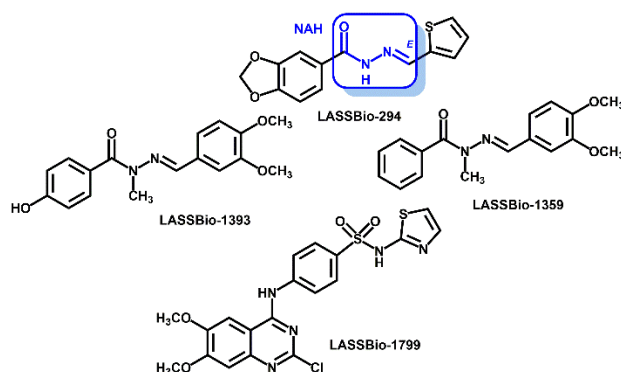
**Keywords:** *N*-acyl hydrazone derivatives (NAH), bioactive compounds, medicinal chemistry.

## ABSTRACT

This presentation will be concerned with part of the medicinal chemistry studies performed at LASSBio (Laboratory of Evaluation of Bioactive Synthetic Compounds) in Federal University of Rio de Janeiro (UFRJ), Brazil, celebrating its 25 years of research activity in medicinal chemistry, designing, synthesizing and evaluating new bioactive derivatives, especially the *N*-acylhydrazone (NAH) class of compounds, which was discovered there twenty years ago.

From some years ago we have started to study this class of privileged compounds [1] and it was possible to identify many original bioactive compounds. In this talk will be presented three bioactive derivatives of NAH chemical class, and a new scaffold of kinase ligand, outside of NAH derivatives, discovered recently in LASSBio.

The NAH derivative LASSBio-294, a cardioactive lead-compound [2], followed by LASSBio-1393, an anti-asthmatic drug candidate and LASSBio-1359, an useful agent to control the pulmonar arterial hypertension [3,4]. Outside of ligand to NAH derivatives, LASSBio described a new ligand of PI4KIII $\beta$ , LASSBio-1799, with a new molecular pattern discovered by virtual screening of its chemical library.



The financial support of the Brazilian agencies CNPq, CAPES and FAPERJ are deep fully acknowledged.

- [1] Duarte CD, Barreiro EJ, Fraga CAM (2007). Privileged structures: a useful concept for the rational design of new lead drug candidates. *Mini Rev. Med. Chem.* 7 (5), 1108.
- [2] Sudo RT, Zapata-Sudo G, Barreiro EJ (2001). The new compound, LASSBio-294, increases the contractility of intact and saponin-skinned cardiac muscle from Wistar rats. *Br. J. Pharmacol.* 134 (3), 603.
- [3] Fraga, CAM, Barreiro EJ (2006). Medicinal Chemistry of *N*-Acylhydrazones: New Lead-Compounds of Analgesic, Antiinflammatory and Antithrombotic Drugs, *Curr. Med. Chem.* 13 (2), 167.
- [4] Thota S, et al. (2018). *N*-Acylhydrazones as drugs, *Bioorg. Med. Chem. Lett.* 28 (17), 2797.

# Climate change and human-political response

Glasmacher, Ulrich A.<sup>1,\*</sup>

<sup>1</sup>*Institute of Earth Sciences, Heidelberg University, Heidelberg, Germany*

*\*Corresponding author. E-mail: ulrich.a.glasmacher@geow.uni-heidelberg.de*

**Keywords:** Climate change, past climate, sun spot activity, jet stream

## ABSTRACT

The presentation "Climate change and human-political response" will describe the complexity and components of a coupled human-natural integrated system that needs a fast instantaneous sustainable development. The terms climate, climate change, and tipping point will be discussed in the frame of the natural-human-political response system. The aim of the presentation is to understand the geological background of the climate evolution in general, and the influencing physical parameters of the recent evolution. Special focus will be: How life on planet Earth, especially humans, has reacted to the dramatic change of climate conditions in the past and recent years. In addition, the influence of climate change to rural societies will be described, discussed, and compared to recent human societies on planet Earth. The presentation will gain insight into the importance of the year 2018 as a year of tipping point.

The final part of the presentation will cover the field of "What is a perfect climate for humans and what does individual humans accept as a perfect climate". Furthermore, the consequences of human behavior will be discussed and a future view on planet Earth and human evolution will be provided.

In addition, the following questions are raised and answered:

- How do human react to climate change?
- What kind of climate humans want to have?
- Is there a special climate favored for human evolution?
- Do we have tool that allows changing climate on planet Earth
- Who has the right to decide, which climate a living area of humans has over time?
- What does the term Geo-Engineering means?

# **Savanna Grasslands – Awakening the sleeping giant?**

Asch, Folkard

*University of Hohenheim, Stuttgart, Germany*

*\*Corresponding author. E-mail: fa@uni-hohenheim.de*

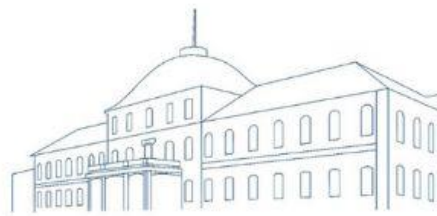
**Keywords:** African Savanna, environmental impacts, Cerrado

## **ABSTRACT**

10 years ago the World Bank published a meanwhile famous article discussing the agricultural potential of the African Savanna ecosystems. The prospects for commercialization of land use was seen as a milestone for development and poverty reduction while the expected environmental impacts should be offset against the benefits. The extensive savanna ecosystems across the African continent were symbolized as a sleeping giant. The parallels to the South American Cerrado ecosystems are inevitably coming to mind; a large part of the Cerrado in Brazil was converted to agricultural production systems, greatly contributing to food security and boosting the economic development of the country.

However, it is common knowledge that these savanna ecosystems will play key role in providing essential ecosystem services and functions in the context of global change and our sustainable development goals. Numerous studies and publications pointed out that savanna ecosystems are hot spots for biodiversity, greatly contribute to carbon storage, are key components for the global fresh water cycling, and essential habitats for wildlife. The conversion of natural ecosystems into agriculture land is always linked to a number of impacts and consequences which should be carefully considered. CO2 emissions, nutrient and fertilizer management, water pathways, land erosion and soil degradation, infrastructure and product market access or the availability of qualified labour and know-how are just some factors among many others which must be assessed for sustainability.

Particularly in Africa, a multitude of often nested interests need to be taken into account when sizing up an ecosystem for potential conversion. This talk addresses the knowledge gaps and the potential overlapping existing activities and tries to elucidate which factors need to be considered when decisions on certain land-use change need to be made.



Abstracts

**Session A1**

**Managing climate and global  
system's processes**



# High resolution quantitative precipitation estimation in Brazil

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**Keywords:** Precipitation estimation, water resources, remote sensing

## ABSTRACT

This work evaluates high spatial-temporal resolution quantitative precipitation estimation (QPE) over Brazil, between 2000 and 2015, by applying the Climate Prediction Center Morphing technique (CMORPH), in which 24-hr precipitation measurements of the Brazilian rain gauge network is merged with respective satellite precipitation estimation. The merging is performed by the statistical objective analysis scheme (SOAS) [1]. CMORPH has ~8-km spatial resolution while the average distance between rain gauges is ~50-km. Daily precipitation accumulations are used. In comparison with SOAS, CMORPH generally underestimates precipitation over Northeast and Southeast Brazil and overestimates over North, Center-West and South Brazil, in spring and summer. There are different precipitation regimes dominated by the annual cycle of convection. For instance, Amazonia has two maxima, in March (301,5 mm) and November (277,8 mm), and a minimum in August (92,7 mm), influenced by the Intertropical Convergence Zone (ITCZ). The wet and dry seasons in Northeast Brazil are between April and August and between September and December, respectively. The Center-West and Southeast regions have a well-defined annual cycle with a rainy season between October and March (spring and summer) and a very dry season between June and August (winter). South Brazil has the smallest annual cycle amplitude, with abundant rain throughout the year. The areal precipitation mean over Brazil presents an annual cycle with a maximum in March (250,7 mm) and minimum in August (46,7 mm). The long-term annual precipitation mean is 1829,8 mm. The highest (2544,8 mm) and lowest (805,2 mm) annual precipitation averages occur in the states of Amazonas and Bahia, respectively.

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# Soil respiration (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O) and land use. An Amazon example

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**Keywords:** greenhouse gases, terrestrial emissions, upland soil, land use

## ABSTRACT

Soils are sources and sinks for greenhouse gases (GHG) such as carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O). To calculate reliable GHG budgets, precise and representative quantifications are needed, since soil storage capacity can be high and their emission power highly variable. Budgets are relevant on a regional level for improved land-use management (agriculture and forestry), and globally to solve open questions on global change issues including climate change. Using a conservative global average flux of 300 mg CO<sub>2</sub>e m<sup>-2</sup> h<sup>-1</sup> (Oertel et al. 2016), global net soil emissions of more than 350 petagrams (Pg) CO<sub>2</sub>e result (CO<sub>2</sub>e = CO<sub>2</sub> equivalents = total effect of all GHG normalised to CO<sub>2</sub>). This number equals roughly 21% of the global soil storage of C and N. For comparison, 33.4 Pg CO<sub>2</sub> are liberated annually through fossil fuels combustion and the cement industry.

To our knowledge for tropical environments, three field campaigns were successfully carried out in the Amazon basin (Amazonas state) in February and March 2016 and 2017, and in July and August 2016 (rainy and dry seasons). Data show 70% higher soil respiration (CO<sub>2</sub>) of forest soils. Total C and N soil concentrations are about 40% (C) and 15% (N) higher in forest soils than in post-forest areas. These differences are explained with higher organic matter turnover rates and higher evapotranspiration in forests, and with larger nutrient export on post-forest areas. These new data are a product of the EcoRespira-Amazon project (<https://blogs.hrz.tu-freiberg.de/ecorespira/>).

We divided the investigation area into two regions – central and south for a statistical correlation analysis. The first one represents more natural tropical rain forest conditions; the latter is a region with more anthropogenic influences. For the central region we found strong negative significant correlations between CO<sub>2</sub>-flux and land use (with categories forest [1] and non-forest [2]), soil humidity and soil temperature, and a significant positive correlation between CO<sub>2</sub>-emissions and total N-content in the organic layer. No significant correlation was found for the southern area. Using a simple soil respiration model, which was originally developed for soils in Central Europe (Reth et al. 2005) we found a very good agreement for the CO<sub>2</sub>-emissions (5.81 μmol m<sup>-2</sup> s<sup>-1</sup> measured vs. 5.41 μmol m<sup>-2</sup> s<sup>-1</sup> modelled) for the central region. For the southern region, not such agreement was observed. Agreement between measured and modelled fluxes was poor for individual sites.

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# Future yields of double-cropping systems in the Southern Amazon, Brazil, under climate change and technological development

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**Keywords:** crop modelling, deforestation, sowing dates, soybean, Mato Grosso

## ABSTRACT

**Introduction:** Climate change is a major threat to agricultural production, particularly in vulnerable ecosystems such as the Southern Amazon, where millions of hectares of tropical forest have been deforested for the purpose of cattle ranching and the expansion of soybean fields. At the same time, genetic progress and improved crop management have led to considerable yield increases in the states of Mato Grosso (MT) and Pará (PA), which are the hotspots of deforestation. The aim of this study is to assess the impact of climate change and technological development on double-cropping systems in the Southern Amazon up to the year 2040. **Materials and methods:** Future crop yields were simulated with the Model for Nitrogen and Carbon in Agro-ecosystems (MONICA), a dynamic, process-based crop growth model [1]. Climate projections are based on the IPCC SRES A1B and were generated with the Weather Research and Forecasting (WRF) model and the Statistical Regional Model (STAR) in a horizontal resolution of 900 m x 900 m. Soybean cultivation was assumed to occur at the onset of the rainy season. A novel approach of forecasting technology-driven yield increases was developed to account for gains in breeding and crop management improvements. **Results:** Results from crop growth simulations indicate that soybean yields will stay nearly unchanged (MG VIII +0%, MG VII +1%), whereas maize and cotton productivity will decrease by 28% and 17%, respectively, between 2015-19 and 2035-40 (average of WRF and STAR scenario). This decline in second season crop productivity is traceable to future lessening of precipitation and higher temperatures. Estimation of technology trends suggests that advances in genetics and crop management are likely to offset the negative effects of climate change by increasing soybean yields by 40% (MG VII +39%, MG VIII +40%) and maize and cotton yields by 68% and 59%, respectively, during the same time period. **Conclusion:** Although technological development is expected to mitigate climate related yield losses, ongoing deforestation with negative feedback loops to the local climate and agro-ecosystem raises doubts as to the viability of future crop production in one of Brazil's and the world's main crop-producing regions.

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# **Multi-objective calibrations of vegetation and soil-water dynamics: An application to grassland ecosystems in Germany**

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## **ABSTRACT**

Grasslands covering around 28% of the agricultural landscapes in Germany are one of the most essential components of the ecosystems. They play key role in protecting the ecological environment and providing food security. Grassland's ecosystem is highly complex due to inextricably high interactions among soil, water, and vegetation components. Understanding these interrelations is of paramount importance to propose management strategies required for a better operation. Although agroecosystem models have been widely used as promising tools for gaining a deeper understanding of these complex systems, they suffer from uncertainties associated with parameters that represent the processes governing ecosystem dynamics. In addition, the interactions between vegetation, water, and soil processes as well as their feedback effect increase model dimensionality, which is viewed as another drawback of these models. Given the fact that these process-based models are parametrically demanding, calibrating parameters/variables that improve the simulation of one process may worsen the simulation of others. That means the estimated parameters are in conflict with each other. This introduces another source of uncertainty to the model reliability.

Reducing model uncertainty is impossible without resorting to calibration methods considering multiple components of the model in a multi-objective calibration framework. Thus a trade-off among simulation of different processes in terms of performance can be achieved under a multi-objective calibration framework. The key goal of this study is therefore to quantify the uncertainty in the agroecosystem model outputs in the light of applying a multi-objective modeling approach. Thus, a simulation model for nitrogen and carbon dynamics in agro-ecosystems, the so-called MONICA, is adapted for simulating grasslands.

The suitability of the model is tested across different regions in Germany. We linked MONICA with the well-known auto-calibration procedure SUFI-2 (Sequential Uncertainty Fitting Procedure) for simultaneous calibration of Leaf Area Index, above ground biomass, and soil moisture dynamics. The non-dominated parameters simulating different dynamics are identified and the uncertainties associated with each model parameter and each output variable are quantified. The methodology implemented in this approach provides profound insight into the usefulness of uncertainty-based multi-objective calibration for agroecosystem systems which makes it suitable to predict agroecosystem behavior under extreme climate conditions.

## DIANA – Greenhouses monitoring and control device

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**Keywords:** climate analysis, controlled environment, electronic system

### ABSTRACT

Agriculture is an important sector of the Brazilian economy, fundamental for the growth of the country. Many rural producers suffer from climatic variations in their plantations, accounting for losses in production, a fall in product quality and consequent increase in the price of horticultural crops. "The potential adverse impact of climate change on Brazilian agriculture and its associated subsistence is an issue on which researchers and producers have given special attention. There is growing concern about the hypothesis that increasing climate variability has significant negative impacts on agriculture, national economic growth, and related subsistence in Brazil" (Pellegrino et al., 2007)[1]. The DIANA project aims to provide the user with an electronic system that acts in the search to ensure ideal climatic conditions for the crop, providing a good development of the production. The device allows the user to view the weather data in real time and the system acts by automatically controlling these properties. It has compatibility for expansion of the control and monitoring, allowing one or more greenhouses to enjoy the same system, being analyzed and controlled independently. This system has a group of sensors that perform the functions of climate analysis. Climate control is done through irrigators, exhaust fans, heating, cooling and lighting systems. Both the monitoring and control systems are controlled through a Raspberry pi microcomputer, with algorithms and electronic circuits developed during the project. The equipment is being deployed in a medium-scale greenhouse for testing purposes by a team of students and teachers in a research nucleus. By observing the operation of the system, we intend to compare cultures performed within the controlled environment with cultivated externally. Therefore, DIANA is an easy-to-use system accessible to several producers. The device allows the user to enter the desired climatic data, providing a system compatible with various crops. A certain saving of water is emphasized, since the system only uses what is necessary for production. In addition, the device does not require solar lighting for production, thus making it possible to use indoor controlled greenhouses.

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# Project of Microcosm System in Saturated and Unsaturated Soil Columns for CO<sub>2</sub> Leakage Biomonitoring

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**Keywords:** CO<sub>2</sub> leakage biomonitoring, MMV, Microcosm, Soil columns

## ABSTRACT

The anthropogenic emissions of CO<sub>2</sub> are increasing and this is one of the causes of climate change. Carbon Capture and Storage Technology is one option to stabilize the concentration of greenhouse gases once the CO<sub>2</sub> is collected at industrial emissions, transported and stored at safe place and away from atmosphere [1]. To guarantee the reliability and efficiency of the storage is needed to introduce and evaluate methods of Measurement, Monitoring and Verification (MMV) of CO<sub>2</sub> [2]. Soil characterization is important to determine possible changes caused by the contact of CO<sub>2</sub> with the soil and identifies its leakage [3]. Microcosm experiments could redeem an important place in MMV methods as would allow to evaluate the effects of carbon dioxide simulation a storage site [4]. This work aims a project of a microcosm system for the controlled injection of CO<sub>2</sub> into saturated and unsaturated soil. For this, a study was carried out in technical references where the main aspects of confection were the size and material of the column. From the study and the availability of materials, a three-column system (biological replicates) was created with continuous upward flow of CO<sub>2</sub> injection from a gas disperser. For the columns with saturated soil, a dispersion and water purge system was added. Through the methodology and the study employed, it was possible to design a test system in columns with saturated and unsaturated soil so that CO<sub>2</sub> percolated throughout the soil present in the column. The system designed also enabled the collection of samples and their analysis.

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# The contribution of university to support the plant for the planet movement

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**Keywords:** University; extension projects; Plant-for-the-Planet

## ABSTRACT

The Plant-for-the-Planet (PftP) is a non-governmental organization initiated by a nine years old German student, Felix Finkbeiner, in 2007. It was a child initiative to encourage new children to plant trees. The method consists of organizing workshops or a one day event for school children in order to inform them about the current climatic condition of the planet. They are encouraged to take climate justice in their own hands by planting trees. After participating of a workshop they are certified as climate justice ambassadors. A NGO movement depends on partnerships to achieve scalable sustainable impacts. One of the ways to offer these workshops in schools and attract new partners is through academic extension programs. This experience takes place in the Federal University of Santa Catarina in the South of Brazil. Undergraduate students from the Energy Engineering program have been organizing and offering PftP workshops in Araranguá schools since 2017. Thereby the present work aims at analyzing this experience to discuss how the university can support non-governmental initiatives through communitarian projects. For this purpose, the study was separated into two phases. Firstly, actors who are responsible for conducting the project workshops were identified. Secondly the aspects which help to expand the PftP movement were discussed. The actors include students and volunteers, ambassadors, PftP program coordinator and professors. The main aspects which positively influence the impact of the project include: the engagement of undergraduate and graduate students most of them acting as volunteers (1) and the attraction of partners (2). The university attracts organizations that have an interest in continuing the collaborative work. Currently through the project the university has established a network of partners. These include the Araranguá region's municipal environment and education secretariats, rotary club, environmental foundation, government representatives, private companies and the media. The combination of factors led to important results: 04 scholarships for undergraduate students working directly in the project, 220 children from fifteen schools participated of the PftP workshops in Araranguá region, 300 trees were planted between 2017 and 2019. Thus, the university can play an important role in disseminating the PftP movement in Brazil.

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## **Forest biomass and areas of permanent preservation in familiar rural properties: the Brazilian new forestry law (NLF)**

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**Keywords:** Rural development, sustainability, climate change, forest resources

### **ABSTRACT**

Brazilian Law n. 12.651 of may, 25 of 2012 discusses native vegetation protection [1]. Sustainable development is its main goal must be reached by principles such as Climate System Integrity preservation (ISC) and Brazilian presence in national and international markets of food and energy (Bioen). Two elements linked with the rural areas and forest resources are also relevant in this law; Areas of Permanent Preservation (APP) and Small Properties or Familiar Rural Possession (PPR) [2]. This article analysed, based on ISC and Bioen, Forest Biomass on the APP situated in PPR possibility. It was developed an exploratory research, with a deductive approach. It was applied a general focus (NLF) until a correlation of the specific aspects analyzed (ISC, Bioen, APP and PPR). Vegetation in APP must be necessarily maintained and, on the eventual suppression, it must be recovered. NLF allows intervention or native vegetation suppression in APP on the "public utility", "social interest" or low environmental impact" condition. The most important APP, considering the main goal of this study, are those located in rural zones and with this classification: (i) marginal range of any natural streaming water; (ii) slopes or its portions higher than 45° inclination, and; (iii) top of hills, mountains or mountain chain [3]. It was determined a sustainable correlation among ISC, Bioen, APP and PPR. NLF permits, in this sense, a APP's sustainable agroforestry management, on the small rural properties situation (PPR), specially on the specific cases above. However, forest management must be realized without environmental function damage of APP. Forest biomass in APP located in PPR has a great potential, considering environmental (Climate Change mitigation), social (familiar farmers) and economic (income generation by products and services of the agroforestry management based on energy forests and native vegetation mix) aspects, to contribute for the ISC and Bioen principles disposed in NLF. It will be necessary, in any event, increase scientific and technology research according to innovation for soil and water sustainable uses and also forest and other native vegetation types restoration and preservation [4].

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## **Preliminary results of artificial intelligence applied to botanical identification means of images aiming at sustainability**

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**Keywords:** Artificial Intelligence, forest, sustainability

### **ABSTRACT**

The conservation of natural resources is extremely important for the maintenance of life on the planet and finding sustainable ways to improve the care of these resources is one of the ways to approach sustainability. In a study done by Nature in 2018 [1], the forest was measured in monetary values, and the estimate was that it is worth approximately R\$ 2.800,00 / hectare, which shows the relevance of the conservation of this complex ecosystem. The application of new technologies is growing in all areas of study, in the forest sector it is no different, and in this context, artificial intelligence appears as a mitigating tool. Therefore, the present work aims to perform the autonomous classification of different forest species through images with artificial intelligence techniques, such as deep machine learning. The study was conducted in the city of Botucatu, Brazil, and the images were collected through a smartphone with a resolution of 5.0 megapixels, and contains 128 x 128 pixels. A total of 79 images were taken, of which 63 were used for training, approximately 80%, and 16 images for testing, approximately 20%. The image classes were divided into 42 images of a guava (*Psidium guajava*) and 37 of a yellow ipe (*Handroanthus albus*). Thus, the preliminary studies described in this summary indicate that deep machine learning is a viable tool in botanical identification, based on the results obtained in the present work and observations in related studies. With predictions of 98.41% accuracy, in the test set we obtained a relevant result. Finally, it has allowed us to conclude that artificial intelligence will bring considerable benefits and will bring us closer to a system of sustainable practices at the global level.

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## **The urban planning importance at the heat island bubbles analyzes in Passo Fundo - RS**

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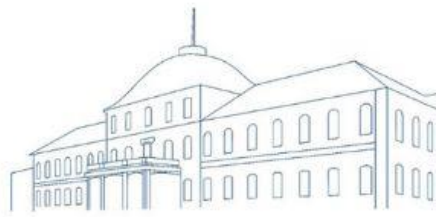
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**Keywords:** Sustainable planning, Heat Island Zones, GIS

### **ABSTRACT**

Day after day it is constructed a new building, a permeable area get concreted, a tree is chopped for the urban development and so on, but its also know that without a green planning the cities began to develop the heat island zones. Those gray areas should have a equal balance with the green areas inside a city, as seen on the Barcelona's urban planning, where its proposed a mixing of construction and open spaces to avoid the effects of the heat island. Due to those previous information, the abstract aimed to evaluate and analyze the existence and reasons of heat island zones near green parks in the city of Passo Fundo – RS, Brazil. The method of analyze were conducted according to Brazilian regulation standards for temperature, humidity and wind at three different open spaces areas in Passo Fundo, the Campus I of the University of Passo Fundo, the Vera-Cruz square and the Ernesto Tochetto Square. The procedure took a series of analyzes through a whole day with a multiparameter equipment over the three places, where at each one were developed aleatorized spot's for testing the climatic results. After the manual collection of the data, the numbers and points were passed to a GIS software, ArcGIS, and through geoprocessing modeling tools were generated several maps for urban heat island analyzes. All those maps were analyzed together with the overlaying of google earth satellite maps, to identify and comprehend the reasons behind the heat island bubbles inside some neighborhoods, seeking the understanding of climatic changes and the urban topology.

As a preliminary conclusion of those analyzes were that unplanned constructions were causing a mass area effect at the heat island zones, changing the whole climatic conditions, wind, humidity and temperature. Also, the change of topology patterns, gray buildings and leak of green areas showed that the places without a similar balance of green and gray were the most propitious areas to develop the heat island bubble inside the neighborhood.



Abstracts

**Session B1**

**Sustainable food production  
systems**

# How Brazil is shifting its livestock production systems towards sustainability

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**Keywords:** integrated crop livestock forest, mitigation, pasture management, sustainable livestock,

## ABSTRACT

Brazil is a country of territorial dimensions where livestock has great economic importance both in the domestic market and in exports. There are a number of buyer countries demanding to meet health, safety, quality and sustainability attention requirements. Among the 10 most emitting countries in the world, Brazil is ranked 7th [1], accounting for 2.59% of all global anthropogenic emissions. Brazilian agriculture contributes a third of emissions, approximately 0.83% of all global emissions. These figures show that activity is not the main player in this scenario, a fact that does not diminish the opportunity for efficiency improvements in the sector. In the last decade the profile of Brazilian emissions has changed significantly: in 2005 Brazil emitted 3.5 Gg of Co<sub>2</sub>eq with 70% coming from LULUCF and 14% from agriculture. In 2014 Brazil emitted 2.1 Gg, 18% of which was LULUCF and 33% of agriculture [2]. Proportionally emissions from agriculture increased, but in gross terms Brazil reduced its emissions by 57%. During this period Brazil increased its cattle herd and reduced its pasture area, using technologies that resulted in higher productivity. There is a wide range of technologies available to mitigate or adapt production systems to climate change [3]. Two of great impact can be listed: proper pasture management and the adoption of integrated crop-livestock-forest or ILPF systems. Pasture management provides higher animal performance, better stocking rate and carbon sequestration in the roots of tropical pastures with large mitigation potential. In ILPF systems carbon sequestration is enhanced in tree roots and trunks. In these two systems it is estimated that it is possible to neutralize emissions of up to two animal units per hectare in a well-managed pasture system and up to 5 animals per hectare in integrated eucalyptus systems. Some Brazilian producers already adopt these sustainable technologies and there is a long way to go nationally, however the trend in this direction is clear.

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## **Less energy is more in apple storage facilities - minimizing fruit losses and maximizing pack-out -**

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### **ABSTRACT**

Rapid cooling during the initial phase of fruit storage is essential to remove field heat and to inhibit fruit quality degradation. During this initial cooling phase, a high energy usage is required. The high energy demand for fruit storage facilities and the rising energy costs call for new strategies which help to reduce significantly energy consumption. The operation of the cooling system, including fans, accounts for majority of energy consumption in fruit storage. The extent to which the cooling system and the fans must operate over the entire storage period is variable, depending on room geometry, insulation and bin stacking. Modern storage technologies with time-dependent, dynamic measurements of fruit quality parameters, aimed to extend the conventional storage period, prove useful to further improve storage conditions and to conserve energy. A promising idea to face this multifactorial system are complex models driven by factors like variety, quality criteria, harvest date, 1-MCP treatment and storage conditions enable the development of decision-making tools, for maintaining at-harvest fruit quality under optimized storage condition with minimized energy consumption. In first tests energy amount during storage period of apples could be reduce to 35%.

## Comparing two family dairy-farm systems in Brazil

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**Keywords:** Voisin system, sustainable production, agroecological transition

### ABSTRACT

A farm system, as any other human activity based on capital-stocks (natural, human, physical, financial, and social), has the characteristics of sustainability if such activity contributes for the achievement of sustainable development. The sustainability measures developed by [1] are in line with the dimensions that bases sustainable development. This study compared different farm systems in Brazil: a semi-intensive dairy system, in the State of São Paulo (SP), based on materials and services from the economy, and a system in transition for agroecologic system, in Rio Grande do Sul (RS). The specific purpose was to identify the subsystems and their interactions. The analysis is based on a methodology for the holistic assessment of an agricultural production system and its analytical structure is compatible to the structure of the five-capital stocks. The study developed conceptual models in the form of the energy system diagram and calculated the energy produced in each system. The major difference in the diagrams is the production of more products and the different forage that compounded the RS system. The production and the energy produced in milk are higher in SP than in RS. The systems are similar in production of animals, and the total energy produced in RS is 76.95% of the production in SP. The products in RS received higher prices and increased both the gross farm income and the Emdolars value (the Em\$). The gross production income in RS was 1.5 times the SP system. The differences in the institutional environment do not permit to transpose the situation from one state to another. The south farm sells its products direct to the consumers, despite not being allowed by the local authority yet. In SP State, the supervision is more intensive than in the RS, so it would be more difficult to sell significant quantities direct to consumers, out of the legal system in SP. Both producers need to be supported for aggregating values to their products according to the legal system.

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# Electric Tractor System propelled by solar energy for family farming in the northeast of Brazil

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**Keywords:** Family farming. Electric tractor. Sustainable energy

## ABSTRACT

In Brazil, family farming is a significant factor in food production. This applies particularly to the Northeast semiarid regions. However, the majority of semiarid family farms lack appropriate motorized agricultural machinery that provides efficient farming. The hypothesis is that farming equipment developed for those specific climatic and farming conditions will increase productivity of semi-arid family farming. In order to make appropriate farming equipment available for this purpose, the project researched the feasibility of a small-size electric farming tractor, propelled by locally available renewable energy, and capable to pull implements tailored for semiarid family farming. Thus, since onboard availability of sufficient energy is a crucial factor for an electrical vehicle, this project investigated as well alternative systems of power supply, in order to enable the continuous operation of the tractor over longer time periods. The evaluated system included a prototype tractor, besides a scheme for local generation, storage and transmission of electric energy. The obtained result was that, in the semi-arid areas of Brazilian Northeast region, with its reliable and low-cost energy source (photovoltaic), the concept of an electric tractor already represents nowadays an economic and technical feasible solution.

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## Trends in livestock pasture system intensification in Brazil and Germany

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**Keywords:** pasturelands, agriculture intensification, meat and milk production, sustainability

Agricultural systems have faced a widely-known challenge: food, energy and fiber production for supply a rising demand for these products in the next decades. Aspects such as population growth, urbanization, and shift of life-standard patterns configure the major drivers to manage natural resources efficiently and therefore achieve energy and food security [1]. Although land clearing/expansion could be an alternative to increasing food production, agricultural intensification is the most environmental-friendly way to reach those needs [2]. Herein, we visited pasture-output production data from ruminants (meat and milk) published by FAOSTAT [3] aiming to identify the livestock potential intensification in Brazil and Germany. Pastureland data were taken by MapBiomass and Germany Ministry of Agriculture (BMEL) for Brazil and Germany, respectively. Despite a dramatic difference in terms of pastureland area of both countries from 1991 to 2017, 115.8 to 143.6 million hectares in Brazil and 5.3 to 4.7 million hectares in Germany, the production levels shows Germany a much more efficient livestock producer. In terms of carcass-weight, Brazil presents a yield rate of  $+1.29\% \text{ yr}^{-1}$ , while Germany has only  $+0.42\% \text{ yr}^{-1}$ . On the other hand, in 2017 the average carcass yield under Brazilian conditions was  $246.6 \text{ kg animal}^{-1}$  whereas in Germany the cattle slaughtered weight was around  $320.3 \text{ kg}$ . When fresh-milk production is evaluated, the differences are higher. Brazil has an average milk production in the period evaluated herein ranging from  $2.1$  to  $5.4 \text{ kg of milk animal}^{-1} \text{ yr}^{-1}$ , while in Germany these numbers are exponentially leveraged from  $14.1$  to  $21.3 \text{ kg of milk animal}^{-1} \text{ yr}^{-1}$ . In a relative perspective, milk production in Brazil has a yearly increment of  $3.9\%$  while the same index in Germany rises of only  $1.6\%$  per annum, suggesting a thin possibility for intensification in this country. Regardless supplemental feed, herd management, and socio-economic incentives, for our knowledge, this is a first Brazilian-German livestock production approach, showing a large room for intensification in Brazil, since the country has suitable environmental conditions in terms of climate and large pastureland area.

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# Environmental degradation of water resources under sugar cane and pasture

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**Keywords:** Environmental degradation, water resources, soil conservation

## ABSTRACT

Changes in the environment induced by land use and occupation in recent years, driven by growing food demand and inadequate soil management and conservation practices, have led to many environmental problems in water sources that are the forming elements of rivers which make up the river basins. The high spatial resolution satellite images are very important in monitoring the environmental transformations that have occurred over time [1]. The objective of this work was to analyze the environmental problems in the affluent of the stream Santa Margarida, municipality of São Manuel, State of São Paulo, Brazil. We used satellite images [2] in the 2008, 2013 and 2017 dates in the analysis of a spring slope occupied by sugarcane and pasture, where in almost a decade, some attempts at soil conservation as the construction of terraces to contain or direct the waters of the rains were not effective, causing some environmental problems with the appearance of erosions of the gully. In addition to the loss of soil in the area caused by the breaking of contour lines, all the material transported by rainfall in 2008 was directed to the tributary of the stream, where with little ciliary vegetation in its extension, caused a large part of the siltation. In 2013, several curves were broken in several places, where the energy flow carried eroded material to the stream in the area closest to the source, showing that in this period of time there was no efficient soil conservation to mitigate problems already identified in the previous year. The satellite image of the year 2017 shows the same problem occurred in previous years, where it is clearly evident the occurrence of several disruptions of the level contouring and directing this time, all the eroded material to the source of the tributary. It is observed that in almost 10 years, actions to conserve soil and water resources were not efficient and capable of avoiding major environmental problems in the region in protected areas by law [3], causing sedimentation of the tributary, stream and spring, contributing in this way to a probable disappearance of the tributary.

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## Study of techniques for measuring and controlling water parameters

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**Keywords:** Agriculture precision - water quality - sensor - Agriculture 4.0

### ABSTRACT

The world population demands a growth in agricultural production, but due to the scarcity of natural resources, especially fresh water, there is a need to produce more with less. An alternative to the solution of this paradigm is the use of agriculture 4.0, which provides the agriculture with the equipment automation, the production remote monitoring, performance control and data analysis in real time, allowing the autonomous understanding of the variations that can affect productivity. The aim of this work is the study of techniques for continuous evaluation of water quality in the context of agriculture 4.0. Our project aims to prove that the traditional technique for checking water quality makes it difficult to implement agriculture 4.0, since it uses pH and salinity measurement by using techniques such as conductivity. In this technique the electrodes remain in direct contact with the water, changing their characteristics in a short period of time, implying a new calibration, and, therefore preventing effective automation. That is why it is suggested the salinity and pH measurement in the scope of agriculture 4.0 through the development of a low-cost sensor without the need for constant calibration. The sensor can be used in a device that monitors and transmits the data, allowing the implementation support systems for the decision and automated control of water use considering the socio-economic needs of the southern region (eg oriculture and fish farming), as proposed by Finlay [ 1]. The study will use the consensus methodology proposed by Ogliari [2], in which the project is divided into four phases: Informational Project, Conceptual Project, Preliminary Project and Detailed Project. In this study we will seek to find measurement techniques that allow the development of a low-cost sensor for continuous monitoring without the need for new calibrations. For this, it is suggested the use the magnetic field induction theories proposed by Silva [3], which may result in technological innovation with the integration of other existing technologies for the automation of water pumps, data transmission and support systems to the decision that enable increased productivity and loss prevention.

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# **Application of mathematical model to promote sustainable groundwater use in highly populated area in Bahia, Brazil**

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**Keywords:** model, management, sustainability, groundwater

## **ABSTRACT**

The Camaçari Industrial Complex is the largest industrial complex in South America, containing over fifty companies and operating since 1978 in an area of 235 km<sup>2</sup> in the Northwestern part of Brazil. This industrial complex is located in the Salvador Metropolitan Area, with nearly 4 million inhabitants. The combination of high population density, insufficient sanitation infrastructure and industrial water demand poses a challenge for proper water resources management.

As part of the environmental activities of the Camaçari industrial complex, a groundwater model was developed with the objective to support the interpretation of groundwater quality and quantity data and to support some management decisions, such as regarding requests for additional supply well installation. This model was built in 2002 and it covers approximately 1500 km<sup>2</sup> in area and 500 m in thickness. It encompasses the Marizal and Sao Sebastiao aquifer system, which is an important regional water supply. As part of this work, this groundwater model was recently upgraded to incorporate additional data and simulate contaminant transport scenarios.

The obtained results indicate the importance of explicitly considering model limitations to simulate groundwater flow and contaminant transport, especially considering that the Industrial Complex is in a geologically heterogeneous and complex environment, located between two hydrographic basins with variable flow patterns and complex surface water/groundwater interactions. This work illustrates how model limitations can be addressed by the Precautionary Principle and the use of multiple scenarios. Despite these limitations, this case study also exemplifies that models are important tools to support management decisions aiming at promoting sustainable use of water resources.

# Controls of groundwater recharge by regional climatic features in Southeastern Brazil revealed using stable isotopes

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**Keywords:** Stable Isotopes, Groundwater Recharge, Climate, South America Monsoon System

## ABSTRACT

Groundwater dependence in Southeastern region of Brazil has increased during last 30 years, especially to meet rising agricultural production and multiples urban uses of water in growing cities. The Bauru Aquifer System (BAS) and the Guarani Aquifer System (GAS) are responsible for supplying water to more than 10 million inhabitants in São Paulo state, and recharge conditions in these aquifers have been poorly studied. Isotopologues of water represent a completely conservative tracer of water movement, making possible determine the relation between precipitation origin and groundwater recharge. Since 2013, groundwater samples from two shallow wells (30 meters depth) and precipitation samples were collected in two sites located in recharge area of BAS and GAS seeking to evaluate how variations on isotopic signal of precipitation could be transferred to groundwater through recharge. Seasonal variations in groundwater levels were modulated by local precipitation regimes and large climatological features, such as 2014-2016 ENSO event responsible by a continuous water levels lowering observed until 2016. Isotopic composition of precipitation in both sites presented a large variation ( $\Delta\delta^{18}\text{O} \approx 16\text{‰}$ ) and were marked by a strong seasonality, characterized by enriched values during dry season and depleted values during wet season. The d-excess values was normally higher than 10‰, indicating the influence of moisture recirculation during air masses displacement. Weighted average values for  $\delta^{18}\text{O}$  in precipitation were -5.70 and -5.10‰, respectively for BAS and GAS sites. Groundwater isotopic composition presented small variations compared to precipitation ( $\Delta\delta^{18}\text{O} \approx 1.5\text{‰}$ ). In other hand, d-excess values had a large variation, and most samples are positioned bellow the local meteoric water line, indicating the occurrence of strong evaporative processes associated to kinetic fractionation along the unsaturated zone. Average values for  $\delta^{18}\text{O}$  in groundwater were -6.93 and -7.25‰, respectively for BAS and GAS sites, more depleted than weighted average precipitation, however similar to isotopic composition of precipitation during the wet season, when the South America Monsoon System is very active and a large amount of vapor recycled from the Amazonian region is available in the atmosphere and responsible by the formation of the South Atlantic Convergence Zone.

# Effects of Shading and Soil Moisture on *Brachiaria brizantha* Biomass in an Integrated Crop-Livestock-Forestry System

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**Keywords:** integrated crop-livestock-forestry, PAR, soil moisture, grass biomass

## ABSTRACT

Components of integrated production systems may compromise each other in competition for resources such as water and light. A smart and sustainable management of these resources is key to an overall successful system performance but often basic information are missing of how components and resources interact. This study analyzed the seasonal dynamics of photosynthetically active radiation (PAR), soil moisture and grass biomass for integrated Crop-Livestock-Forestry (ICLF) demonstration plots in Campo Grande-MS, Brazil.

Data were collected at three ICLF plots consisting of grass pasture (*Brachiaria brizantha* BRS cv. Piatã) lined with east-west orientated strips of 20 m high Eucalyptus trees (*Eucalyptus urograndis*) in 16 m distance. PAR (AccuPAR CP-80), soil moisture (DELTA T FDR) and grass biomass (moving cages) were sampled in each plot in a line of five sampling points between tree rows to represent the shading gradient.

During rainy season (Dec – Feb) the PAR gradient was extremely high ranging from on average 1300  $\mu\text{mol m}^{-2} \text{s}^{-1}$  (center positions) to only 180  $\mu\text{mol m}^{-2} \text{s}^{-1}$  near trees. In contrast due to lower inclination all points receive more or less the same amount of PAR (500  $\mu\text{mol m}^{-2} \text{s}^{-1}$ ) during dry season (Jun – Aug). For soil moisture we measured a clear gradient from on average 29-32 Vol % at center positions to 20-25 Vol % near the tree lines. Dry season revealed same pattern with on average 3-5 Vol % lower values across the gradient. Biomass distribution showed a clear gradient as well with twice as much DM in center positions for both seasons, while DM was about halved during dry season.

Although we recorded a very high variation of PAR across the gradient between trees during rainy season, soil water content appears dominant affecting grass biomass growth according to correlation analysis. This relation was not surprisingly tighten during dry season when soil moisture contents approach wilting points more often. However, differences in energy budgets across the gradient and seasons resulting from radiation inputs are tremendous and should be considered in follow up analysis and management strategies of ICLF systems in relation to tree distances and height.

# Composting vegetable residues of the preparation of meals in school of basic education of Arroio Grande\_RS\_BRAZIL

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**Keywords:** vegetables waste, water availability, germination tests, homemade garden

## ABSTRACT

Currently, most agricultural production occurs in distant territories from where these products are consumed. This model promotes the removal and depletion of nutrients in agricultural soils and their accumulation in areas where plant products are consumed, usually resulting in environmental pollution. One way to mitigate these two problems is through the agricultural exploitation of organic residues, providing the return of part of the nutrients extracted from the agricultural soils. The knowledge of the values of N, P and K, present in organic tailings constitutes the basis of fertilization of each cultivation to achieve the desired productivity. Composting, among recycling technologies, is basically a form of stabilization of a residue. Tree pruning and vegetable waste from the canteen and cafeteria of students are abundant supply materials at the IFSul Pelotas campus and in many State schools in RS.

It aims to develop, apply and evaluate technologies of composting processes of the mixture of tree pruning and vegetable residues of the school kitchen with sawdust and verify the performance of the compound obtained in tests of production of food, vegetables and Medicinal/phytotherapeutic herbs in organic system compared to commercial substrate. The composting will be carried out with different proportions between pruning of trees and vegetable residues of cooking, plus sawdust, evaluating several characteristics over the 120 days of process duration. The analytical results of the compound will be obtained with parameters of humidity, density, pH, N, C, Ca, Mg, P, K, B, Fe, C / N ratio (US EPA, 1976; APHA, 1992), Zn and Copper, as well as a detailed bibliographic review on composting. Report of Soil Analysis will be carried out through methods of analysis used by Embrapa Agrobiology, Department of Soils of the Institute of Agronomy of UFRRJ and Laboratory of Soil Fertility of the Institute of Agronomy of UFPel. Interpretation and conclusions will be made through Statistical Software InfoStat (Ver. 2010) -R2.11.0 and MindManager X5 Pro. A few examples are proved:

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# **Analysis of the opportunities for integrating agroenergy and agroecology in the microregion of Araranguá / SC / Brazil**

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**Keywords:** Agroenergy, Agroecology, Public Policies, Actors, Araranguá South of Brazil.

## **ABSTRACT**

Brazil with its vast territorial extension has its economy strongly based on agribusiness sector. Therefore, pesticides have been intensively used. Nevertheless, in the past decades the country has assumed international commitments in environmental and climate protection areas. Consequently they affect internal public policies aimed at reducing agriculture's impact on the natural environment. The production of food and energy in a sustainable way is possible through the integration between agroecology and agroenergy. In this context, this study aims at mapping and analyzing the public actors and policies which can promote the integration of agroenergy with agroecology in the Araranguá / SC microregion, located in the extreme South of Santa Catarina State. The region is made up of fifteen municipalities and has a rural population estimated of 20,000 producers. Its main agricultural activities include rice cultivation, broiler and beef cattle breeding, dairy production, tobacco cultivation and olive groves. Among the agroecological cultures stands out cultivation of banana, dragon fruit and passion fruit, lettuce, tomato, cassava and other greenery. This study will be carried out through a bibliographical and documentary research associated to the application of questionnaires to local governmental actors such as research and education institutions, cooperatives, local government representatives among others to identify the possibility of bringing together agroecological management of crops with the valuation of residues for the production of biofertilizer and biogas. The present work intends to generate subsidies to promote the strengthening of national and state public policies. These include the National Plan for Agroecology and Organic Food Production in Brazil - PLANAPO, Law 10.831, established in December 2003, the Low Carbon Agriculture Plan - ABC Plan, proposed in accordance with the Brazilian National Plan on Climate Change, established by Law 12.189 in December 2009 and the Clean Energy Program proposed by the Santa Catarina state government in 2014. Moreover the study aims at promoting reflection of the actors involved on the importance of the theme, with a view to improve quality of life, environmental preservation and sustainable rural development.

## **Automation of a mini domestic stove by arduino microcontroller**

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**Keywords:** Arduino, automated control, vegetables, residences

### **ABSTRACT**

The shortage of space inside domestic locations and its limited capacity in providing the best conditions for the plants to grow and develop are major factors that restrict domestic farming in an urban lifestyle. Low cost technologies for automatic control, of which the Arduino platform stands out as a microcontroller, enables the optimization of small-scale production of plants. Therefore, the purpose of this work was to develop an equipment with automated control of variables, allowing indoor cultivation of vegetables, using the Arduino prototyping platform. Four seedlings of *Lactuca sativa* L. were cultivated in vegetable substrate from 10/09 to 24/09/2018 to test the viability of the project, concerning its general functions and monitoring of operational parameters, such as temperature, relative humidity, photoperiod and substrate water content. The machine was able to maintain pre-determined temperature and relative humidity values, and also proper illumination. Operational failures were detected in the humidity sensor at times. The total expense of electronic components was estimated at R\$351,00. At last, the viability of the Arduino-based equipment was attested, and future optimizations are still necessary in order to reduce costs and allow large-scale production.



# Obtaining chitin with environmental, economic and social sustainability

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**Keywords:** chitin, chitosan, calcium carbonate

## ABSTRACT

This study presents an innovative process of chitin production. Compared to current methods, it has a lower environmental impact, lower energy consumption and can increase the income of vulnerable populations.

Its raw material is the residue from industrial shrimp processing. The global shrimp market deals with around 8 million metric tons of biomass per year [1], with a CAGR of 5%. Meat accounts for only around 50% of the mass of a shrimp, and the residues from its extraction, when not used immediately, are deposited in landfills, or returned to the sea. In producer countries, processing is the exclusive task of women, whose salary is around US\$ 9 daily [2].

Crustacean residues contain calcium carbonate, chitin and proteins. When isolated, these materials have high added value. Chitin is a biopolymer similar to cellulose, and its main derivative is chitosan. The latter has received much attention due to its role as a functional biopolymer in many fields, as it has unique biological and physicochemical properties. Chitosan is used in medicine, agriculture, sewage treatment and cosmetology. The chitosan market is very private [3], but recent estimates place its CAGR at more than 10% within the pharmaceutical industry [4].

Traditionally, to obtain chitosan, an initial stage of chitin isolation is required. To this end, the protein is removed by employing NaOH and heat. For demineralization, HCl is used under heating, with the consequent emission of CO<sub>2</sub> into the atmosphere. These are the two steps necessary to obtain chitin, the precursor of chitosan.

The process developed in LACER has as a main feature the extraction of chitin without heating, and with CO<sub>2</sub> sequestration. The initial treatment can be performed by the communities responsible for shrimp processing. In environmental terms, the process avoids the effects of improper waste disposal and of CO<sub>2</sub> emissions, producing chitin and allowing the production of chitosan and calcium carbonate.

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## Diversity of phytohormones within microalgae

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**Keywords:** Biofertilizers, biomass production, metabolites, phytochemicals, plant growth regulators

### ABSTRACT

The supply of exogenous sources of vegetable hormones (phytohormones) seems to be a promising way to exploit plants physiological potential, aiming increases in plant biomass production. Algae may be a good natural source of interesting phytohormones, because of its fast growth and adaptability. Here we report the evaluation of nine strains of microalgae isolated from the Brazilian biodiversity and maintained in the the Algae Biotechnology Lab, Embrapa Agroenergy, made to check out their potential to produce phytohormones of interest. Strains were grown in a regular J1 media and their biomass was collected at maximum growth phase. Biomass was lyophilized and solid-phase extraction methods were optimized using a commercial polymer anion exchange resin (PAX)<sup>[1]</sup> and a polymer cation exchange resin (PCX)<sup>[2]</sup> to separate acidic and alkaline phytohormones. A metabolomics protocol using UHPLC-MS/MS<sup>[1]</sup> was employed to identify and quantify metabolites in the samples extracts, in comparison to standard chemicals of nine main composts described in the literature as phytohormones (jasmonic acid, indole-3-acetic acid, indole-3-propionic acid, indole-3-butyric acid, gibberellic acid, abscisic acid, salicylic acid, trans-zeatin and trans-zeatin riboside). Results indicate that all nine strains of microalgae produced indole-3-acetic acid and isomers of indole-3-propionic acid in the evaluated conditions (and two strains produced only these compounds), as well as other phytohormones of interest, although with a broad diversity. One strain also presented isomers of jasmonic acid, abscisic acid, and trans-zeatin riboside. A similar one presented an isomer of indole-3-butyric acid, but no trans-zeatin riboside. Four strains showed the presence of indole-3-butyric acid isomers. Such diversity in a small group of microalgae from Tropical environments indicates that there is a great potential to be exploited. Next steps of this research includes the selection of microalgae strains with larger contents of phytohormones, ways to improve their biomass and desired content, how to extract and conserve them, and how to provide them to plants, aiming to enhance physiological activity and growth, thus increasing overall plant production. This may be a new input to ensure food production in a sustainable way.

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<sup>[2]</sup> Cao, Z Y et al. (2016). Profiling of phytohormones and their major metabolites in rice using binary solid-phase extraction and liquid chromatography-triple quadrupole mass spectrometry, *J. Chromatogr. A* 1451:67-74.

# Comparison of herb species in ecological production using composttea

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**Keywords:** Horticulture, Ecological production, Compost, Herbs

## ABSTRACT

The cultivation of wild herbs and salad herbs offers a rich variety for salads and Smoothies. In addition this allows producers to expand their range of products.

During the summer months of 2019 LVG Heidelberg is testing five different species (Mesembryanthemumcrystallinum, Rumexsanguineus var. Sanguineus, Perillafrutescens var. Crispa, Amaranthus tricolor, Brassica juncea). Relevant criteria are the suitability for commercial ecological production and the characteristics of yield (height, weight, phenotype, germination).

Additionally the trial attempts to gain insight into the effects of composttea on the plant health. The application will herefore be done during the sowing of the herbs and before the planting.

First results will be obtained after analyzing of data of the first cut. The plan is to do a second cut after six weeks of cultivation time.

## **The Situation of Agrochemicals in Brazil**

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**Keywords:** agriculture, contamination, health

### **ABSTRACT**

Brazil is one of the countries that consumes the most pesticides in the world. Several studies have demonstrated the impacts of agrochemicals on health and the environment. Among the health impacts, eight Brazilians are contaminated with pesticides per day, and it is estimated that, in each case notified, there are 49 others that are not. The objective of this work is to expose structural elements responsible for this serious situation to human and environmental health. The agribusiness model, the strong political power of the rural sector, the weak organization of workers in the countryside, tax exemptions to pesticides and lack of information to the consumer, among others, have been factors that favor the high levels of use of these substances. This unfavorable picture was not enough, nowadays it is tried to approve in Brazil an even more permissive legislation (PL 6299/2012), called PL of the poison. In a country where fungicides, acaricides and insecticides, banned in the countries of Europe, continue to be used on a large scale. In the year 2018, about 450 agrochemicals were released in Brazil, and in the first hundred days of this year, 152 active principles were released. In addition, the legislation in force on the role of the state in releasing and analyzing levels of pesticides has favored agribusiness to the detriment of health, food and environmental security of the population. Control actions and detection of residues in food, water and the environment are ridiculous.

The Paraná state is unable to analyze even half of the legally released active ingredients, while Ordinance No. 2.914 / 2011 provides for the analysis of only 27 substances. In relation to water, in Brazil 5000 thousand times more are allowed, the amount of glyphosate in water (BOMBARDI, 2017) than allows the European Union. The Brazilian State is conniving and even favors the excessive use of pesticides. On the other hand, spaces of social reaction against the exacerbated use of agrochemicals have increased, both in the academic sphere, as in different urban segments and consumers in general.

# Occurrence of root mealybug *Dysmicoccus* sp.(HEMIPTERA: PSEUDOCOCCIDAE) and other soil organisms in the culture of Rhubarb (*Rheum* spp.) in Mandirituba, Paraná, Brazil.

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**Keywords:** edaphic fauna, tubercle, leaf chlorosis

## ABSTRACT

The rhubarb cultivation is carried out on a small scale, being predominant in vegetable gardens, mainly in southern Brazil, where autumn and winter mild temperatures favor its development and where the Europeans descendants have maintained this cultivation habit. *Dysmicoccus* sp. is a root mealybug most present in pineapple and coffee crops, and has never been register in rhubarb cultivations in Brazil. The present work shows the occurrence of *Dysmicoccus* sp in rhubarb plants collected at the Mosteiro do Encontro in Mandirituba, Paraná. During a technical visit, leaf chlorosis were diagnosticated in rhubarb plants, associated with root rotting. Four rhubarb samples were brought to the soil biology laboratory at the Universidade Federal do Paraná (UFPR) where the organisms were collected from samples, and these were screened and identified by Diagnostic Center "Marcos Enrietti". Among the symptoms, tuber rot was observed, associated with the presence of the root mealybug (*Dysmicoccus* sp.). These generalist mealybugs when feeding on sap, inoculate a toxin in the plant<sup>1</sup>, causing the symptoms observed. In addition to this mealybugs, other types of animals were found colonizing the rotting tubercles as ants, spiders, earthworms, slugs and coleoptera. In total, were collected 58 individuals in total and 10 distinct taxonomic groups. After this survey, it was recommended to change the planting site, emphasizing the need for good drainage and therefore from raised beds, the acquisition of uncontaminated sprouts or seeds. Those recommendations were alternative managements to organic rhubarb cultivation.

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# Sustainable Intensification and Diversification? A Case Study of a Farm in Brazilian Amazonia

Seidel, Anna<sup>1,\*</sup>; Brazilian settler *in memoriam*

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**Keywords:** Agro-silvo-pastoral systems, Amazonian region, pasture management

## ABSTRACT

Over the last decades, settlers along the unpaved roads in Brazilian Amazonia converted forest to cropland or pasture. The widespread deforestation and the continuing urbanization in this region are perceived as threats to sustainable development. Recent debates focusing on the unsuitability of this region for agricultural production outweighed those around sustainability efforts of individual settlers. Therefore, this contribution addresses ecological-economic viability of a farm close to Anapú in the state of Pará, Brazil.

The studied farm was composed of primary and secondary forest, pasture, and crops such as cacao, açai berries, mangosteen, rambutan, bacuri, maracuya, and oranges. With improved access to livestock markets and drops in cocoa revenues, the importance of cattle production and pasture management increased. All Nellore cattle for meat production received health treatments on a regular basis. Recorded annual live weight gain averaged about 167 kilograms per animal. Between crops and native timber and palm trees, pasture was dominated by the perennial grasses *Brachiaria humidicola*, *B. brizantha*, and *B. decumbens*. Rotational grazing decisions in this agro-silvo-pastoral system were based on pasture condition, the growth stages of trees and crops, the presence of parasites and diseases, the nutritional requirements of livestock, and labor availability. Stocking rates below two livestock units per hectare underutilized the pasture, indicated by relatively high standing biomass of about five tons dry matter per hectare. Pasture resources were used more efficiently at stocking rates above three livestock units per hectare, suggested by relatively high palatability and regrowth rates of forages. The rotational grazing system rendered dairy production impossible. Thus, milk was purchased to generate additional income by producing self-made fruit yoghurt that was dyed by using fruits of different palm tree species.

Despite the intensification of cattle production, the number of native plant and crop species on the farm increased, which in turn allowed us to examine their suitability for intercropping and livestock presence. The successful integration of diverse farm components conserved wildlife species, nearly eliminated chemical applications, and increased livestock and crop yields and revenues. The wide knowledge of the settler combined with the research results contributed to the extension of management options for sustainable land use.

## **Work of linkage with an agrotechnical school to create opportunities for rural development from the cultivation of *Acrocomia totai*.**

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**Keywords:** Alternative crops, Rural development, High schools, Rural root

### **ABSTRACT**

The native palm *Acrocomia totai*, which belongs to the family of the palmáceas, has a high potential for the production of oils for industrial purposes. Both for the biofuel industry and for the cosmetics industry because they are rich in lauric acid. The yield is 10 (ten) times greater than that of Soja, which is the main oleaginous crop in Argentina, and its production could generate a very interesting alternative for the provinces of the northeast of Argentina (NEA). The fruits obtained, in addition to their high oil content, have an edible pulp, both for human use and for animal use. The pulp contains sugars, which also makes this fruit an option for fermentation and then obtaining bioethanol. In Brazil, the subject has been researched and deepened, while in Paraguay it has been commercially exploited for more than 70 years and there are at least 15 processing plants already installed. The project promoted by the Faculty of Agronomy of the UBA treats the joint work with establishments of average education of the provinces of the NEA. The goal is to network and research together with students and teachers, so that schools are knowledge generation centers and the main actors of the process. Discover the different actors, based on participatory and collective work. In this context, a pilot experiment is being carried out with the School of the Agricultural Family (EPT), in the city of Santa Lucía, located in the department of Lavalle of the province of Corrientes.

The school authorities welcomed the productive alternatives and technological innovations that small producers can incorporate, since it could be an alternative for rural development in the area. The school is located in a region that was traditionally dedicated to the tobacco industry, but is currently engaged in horticulture. However, technological changes and the economic situation are displacing small producers to the urban area, who nowadays need viable production alternatives for the scale of their establishments.

## **Evaluation of organomineral fertilization in the culture of sugar cane**

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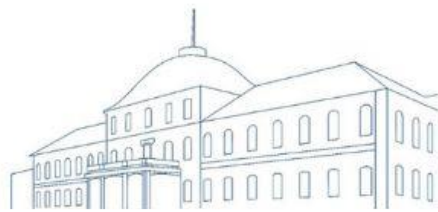
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**Keywords:** Productivity, sewage sludge, sustainable agriculture system, fertilizer

### **ABSTRACT**

The use of sewage sludge in agricultural soils is beneficial for the development of sustainable agricultural systems. Its main benefits are the incorporation of macronutrients (nitrogen and phosphorus) and micronutrients (copper, iron, manganese and molybdenum, zinc). Thus, the present work had as objective to verify the effect of organomineral fertilization on the productivity and quality of the sugar cane crop. The experiment was carried out in a randomized block design consisting of 6 treatments and 4 replicates as defined: without fertilization, mineral fertilization (5-25-25) 100% of the recommendation, organomineral fertilization 50% of the recommendation, organomineral fertilization 100% of the recommendation, fertilization organomineral 150% of the recommendation and organomineral fertilization 200% of the recommendation. All recommendations were made according to the phosphorus (P) requirement of the culture. Chemical and technological biometric parameters of cane plant and cane soca were evaluated. In both sugarcane and sugarcane plantations, the diameter, number of stalks, height and tillering did not show significant influence among the treatments, while the Ton of Twig per Hectare (TCH) showed that the treatment with mineral fertilization presented the best result. The technological parameters of the sugarcane plant presented, for purity, adequate values with the chemical fertilizer and control, for POL and values of Sugar and Alcohol Starch the best values were in the chemical fertilization. On the other hand, the technological parameters of sugarcane soca, the POL and Recoverable Theoretical Sugars (ATR) had their best results in the organomineral fertilizer 200% of that recommended by the P content. The yield of soca sugarcane was higher in all treatments compared to the values of the cane plant and the highest value of productivity in cane soca was also of the organic fertilizer 50% of that recommended by the content of P.





Abstracts  
**Session C1**  
**Improving human health**

## **Studies for the discovery of new antitumor candidates**

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**Keywords:** cancer therapies, tumor, antitumor

### **Abstract**

Cancer is a serious public health problem worldwide, victimizing millions of people annually. Targeted cancer therapies, which include mAbs and small molecule inhibitors, have significantly changed the treatment of cancer over the past 15 years. They are designed to interfere with specific molecules necessary for tumor growth and progression, aiming to fight cancer cells with more precision and potentially fewer side effects. Drugs for targeted therapies are primarily tyrosine kinase inhibitors that have noticeably changed outcomes for some cancer diseases. In this summary, we will present the efforts of our research group aimed at the search of new antitumor candidates, acting through the inhibition of epidermal growth factor receptor (EGFR) and phosphoinositide 3-kinases. The molecular design, docking studies, synthesis and the cytotoxic effect of new EGFR and Pi3K inhibitors will be presented and discussed.

# **Drug Design and Discovery for Neglected Diseases in Brazil: Perspectives of Partnership between Academia and Pharmaceutical Industries**

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**Keywords:** neglected diseases; research on academia; research on pharmaceutical industry

## **ABSTRACT**

Neglected diseases have been a challenge not only for poor countries, but also for some developed one, as the immigration has taken its part. World Health Organization has listed 19 diseases classified as for neglected populations [1]. They affect 149 countries, comprehending about one billion people, in a cost of more than one billion dollars every year for the developing countries. Considering the armamentarium for the treatment of those diseases are, normally, scarce, is of utmost importance to search for new and better chemotherapeutics. In Brazil, there are at least 9 neglected diseases, whose localization corresponds to their low Human Development Index [2]. Some public universities in Brazil have been working on the design and discovery of new drugs for the most important neglected diseases, as Chagas disease and leishmaniasis, among others. They have been using different Medicinal Chemistry approaches and many sources, including natural ones, to find new hits and leads. Most of them succeeded and promising molecules have emerged from their studies. For most of the groups, concluding the pre-clinical tests according to the regulatory Brazilian agency has been a challenge, making it difficult to proceed to the clinical phase. The support of pharmaceutical industries, ideally, the national ones, in consortia with some organs as DNDi [3], mainly in those phases, has shown to be essential. Fortunately, the paradigm of many pharmaceutical industries has changed specially for those engaged in open innovation. For this very reason, the partnership between academia and pharmaceutical industries must be highly enhanced. This presentation will show the scenario in Brazil in this important topic, enhancing the needs for the improvement of the human health in the area.

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[3] DNDi. Parcerias estratégicas. Retrieved on August 13, 2019 from <http://www.dndial.org/parcerias-estrategicas>.

# Comparison between indicators of age-friendly city projects for sustainable management

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**Keywords:** Age-friendly, Public Policies, Urban Planning

## ABSTRACT

Aging population and the need of urban planning of cities to accommodate this population change, this article presents and compares two political, sustainable and social projects implemented between 2000 and 2012: the "Friendly City of the Elderly" Project of the World Health Organization (WHO) and the Project "Affordable City is Human Rights"(2), of the Secretariat of Human Rights of Brazil. As a methodology, the framework was structured by Alvim and Castro (1), which outlines the elements of evaluation and characterization of public policies. What is important in this process is the correlation between the conceptual structure, which bases the public policy, as its operationalization, evaluating the management and the criteria of implementation, and the effective results, in social and urban scope. It is evaluated and analyzed the conditions that are offered through heterogeneity, collecting information with a specific group can generate a distortion of results, if only this group were analyzed. While analyzing the information that exposes the scope of the projects, some consonances that reflect the subjectivity, the mitigation of intentions and the direction of responsibility for the municipal powers in force are perceived, and not as long-term policies in favor of the city and society. Regarding the design of the projects, in terms of motivation and context, the WHO project declares innovation in the methodology of city evaluation. The Brazilian project, in turn, declares its intention to strengthen an existing policy, but little accomplished by the various spheres of municipal, state and federal government, due to the lack of collection and inspection. The main guideline of both projects is to establish accessibility as a starting point for decisions and approvals. However, there is a significant difference between projects. The World Health Organization mentions the importance of conducting field research with focus groups, noting that the effectiveness of the established plans using the checklist of the Friend of the Elderly City Guide will be greater if the number of people interviewed are comprehensive. The Brazilian Project focuses on quantifying the existence of equipment or services, but does not measure the extent of service in the city or region.

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# SOFIA - Optical system of operation and medical analysis

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**Keywords:** clinical exams, efficiency, humanoid robot

## ABSTRACT

The nursing is an area of extreme relevance for the society which contributes for health not just of Brazil, but of the entire world. It is an area which demands a lot of psychological patience not just from the professional, but from the infirm too, however the accumulation of patients makes this job be more complicated. Thereby, the scarcity of time creates a delay in the personal treatment making wherewith, many individuals have their diseases aggravated causing a certain discomfort regarding elderly and children. The Project SOFIA (Optical System of Operation And Medical Analysis), in your first phase has for objective afford to hospitals and related places, an electronic system which can guarantee a chance to attend the patients with more efficiency, being able to sustain an improvement in the hospital row and an enrichment on the attendance accomplished by the nurse of the area. The device would enable to the professional the capacity of perform a screening quickly, efficient and noninvasive, based on the results of the conventional clinical exams like, temperature acquisition and glucose level. Being the last a sensor, which was developed in an undergraduate thesis of electrical engineering from IFSUL CAMPUS PELOTAS which consist in "Monitoring system for continuously and non-invasively to the human body based on methods of spectroscopy and photoplethysmography" (CARDOSO, Samuel dos Santos, 2017)[1]. At future phase 2, the project would add more sensors with the objective of supply more exams like, neurological test with the technique of near IR spectroscopy. The initial idea is to make a humanoid robot to do interactions with the patient and simultaneously perform the acquisition of temperature of the infirm. On the final process, the obtained data from the exams would be sent to the active professional. All mechanics are controlled by a programmable microcomputer, which is very versatile for upgrades and posterior changes in the project. The SOFIA features several advantages, like an improvement in the efficiency of the attendance from the hospitals and related places, because the system is able to examine the person very quickly without there being a worsening of the line.

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# Dual JNK and p38 MAPK inhibitor strongly inhibit hepatocellular carcinoma viability and proliferation

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**Keywords:** MAPK, small molecules, hepatocellular carcinoma

## ABSTRACT

One of the most frequent human cancer and one of the leading causes of cancer mortality worldwide is the Hepatocellular carcinoma (HCC). The development of this cancer is usually associated with patients with previous liver damage, such as chronic hepatitis B and C, hereditary disorders, chronic alcohol consumption, certain metabolic disorders, all cirrhosis-inducing conditions and mutations in one or more genes. The most important signaling pathways involved in HCC are growth factor-mediated angiogenic signaling vascular endothelial growth factor (VEGF), platelet-derived growth factor (PDGF), epidermal growth factor (EGF), insulin-like growth factor (IGF), hepatocyte growth factor (HGF/c-MET), the mitogen-activated protein kinase (MAPK), phosphatidylinositol-3 kinase (PI3K)/AKT/mammalian target of rapamycin (mTOR), oxidative stress and WNT/b-catenin pathway. Targeting one of these pathways or identifying a new one may provide alternative therapeutic targets for the HCC. JNK and p38 MAPK regulates cell cycle, cell proliferation, differentiation and survival. There are studies indicating that p38 MAPK can negatively regulate JNK activity. These proteins can act as a tumor suppressor or oncogenic in specific cell types, so, targeting JNK and p38 pathways could be considered for therapeutic applications. Three kinases inhibitors, sorafenib, regorafenib and cabozantinib, have been approved to treat patients with HCC, nevertheless, there aren't effective treatment. Sorafenib inhibits the MEK/ERK pathway that controls ROS production in HCC. In this respect, the aim of the study was to investigate the potential of new p38 MAPK and JNK dual inhibitor and the possible mechanisms in hepatocellular carcinoma cells. Cell proliferation were assessed by the MTT assay. Clonogenic assays were used to analyze the colony-formation and the protein expression were analyzed by western blot. We showed a strong reduction on the cell viability of HepG2 cells treated with the dual inhibitor. Hepatocarcinoma cells showed a decreased ability to form colonies compared to the cells without treatment. The observed decrease in proliferation was associated with p38 MAPK protein levels and we determined that ROS generations is probably involved in cell death, because NAC, an antioxidant, blocks the effect of the inhibitor.

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# Evaluation of ionizing radiation toxicity and its influence on the adenosinergic system in zebrafish

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**Keywords:** Ionizing radiation; Zebrafish; Purinergic system; Adenosine

## ABSTRACT

**Background:** Exposure to ionizing radiation by environmental sources and medical procures and can result in toxicity, with deleterious health effects [1]. Adenosine is a nucleoside that exert anti-inflammatory actions, and promote tissue protection and repair [2]. Zebrafish is a suitable animal model for toxicological evaluations, and express the adenosinergic system components, including adenosine receptors (P1R) and the enzymes responsible for adenosine metabolism (CD73 and adenosine deaminase; ADA) [3,4].

**Objectives:** To evaluate the toxicity induced by ionizing radiation and the involvement of adenosinergic system in this process in zebrafish early life stages.

**Materials and Methods:** In a 12 well plate, AB zebrafish with 24 hpf were exposed to different doses of gamma rays (2, 5, 10, 15 or 20 Gy) using a Cobalt Theratron Phoenix equipment. A survival curve was performed for 7 days (75 larvae/group). Survival curve was analyzed by Kaplan-Meier method. Using a stereomicroscope, at 48 hpf, embryos heartbeats were counted for 1 min (30 embryos/group). Morphological changes evaluated were: body length, ocular circumference and pericardial edema of 6 dpf larvae. Measurements were done using NIS-Elements D Software for Windows 3.2 (30 larvae/group). Statistical analysis were performed using one-way ANOVA followed by Tukey's test. Ectonucleotidases and adenosine deaminase activities were performed by spectrophotometry as described previously (35 larvae/group, n=8) [4]. Gene expression of P1R subtypes (A<sub>1</sub>, A<sub>2A1</sub>, A<sub>2A2</sub> and A<sub>2B</sub>) were determined by quantitative real time PCR (20 larvae/group, n=4). Results were analyzed by Student's *t* test, considering *p*<0.05 as significant. All protocols were approved by the Institutional Animal Care Committee (CEUA: 7683).

**Results:** No significant mortality was observed. All doses of gamma radiation increased embryos heartbeats. Exposure to 10, 15 or 20 Gy induced decrease of body length and ocular circumference, and 15 and 20 Gy increased pericardial edema. 10 Gy of gamma radiation decreased CD73 and ADA enzymatic activities, and decreased A<sub>2B</sub> receptor gene expression.

**Conclusion:** The adenosinergic system is involved in the toxicity induced by radiation. Further studies will be conducted to explore adenosine signaling as a pharmacological target in the management of the damages caused by radiation exposure. **Funding:** PUCRSINFRA, CAPES, CNPq and FAPERGS.

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# Relation between work place environment, well-being and productivity

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**Keywords:** Sustainability, Well- being, Efficiency, Commercial Buildings

## ABSTRACT

The need for more environmentally sustainable buildings is receiving increased attention all over the world. While its proven relation with the electricity and water consumption directly impacting on the rising CO<sub>2</sub> emissions, implementing sustainability requires a cultural change in how to use and plan spaces. When considering all possibilities of edifications usage: residential, commercial and services; humans spend 90% of their lives indoor [1]. Taking into account only commercial buildings, employees spend a total of 2.080 hours every year in offices [2], making the conditions of the working place a vital key on the health of the population. The aim of this research is to study factors that associate the health-related issues to the performance of edifications and how it affects the users. The health and well-being in commercial buildings are intrinsically linked and one of the top five emerging themes in commercial real estate [3]. According to the World Green Building Council [4], there are eight actions that can modify an office into a healthier space, they are: Indoor Air Quality and Ventilation, Thermal Comfort, Noise and Acoustics, Biophilia, Daylight and Lighting, Interior Layout, Look and Feel and Location and Amenities Access. The first three aspects have a major influence on the employee's productivity. When controlling the impurities on the air, such as volatile organic compounds and amount of carbon dioxide it is possible to have an increase of 101% on cognitive activities. By allowing the users to regulate the temperature according to what they consider to be comfortable it is possible to avoid a decrease of efficiency of 6% when feeling warm and 4% with cold temperatures. Controlling the acoustics of offices can avoid 66% of distraction. Taking into account the high percentage of time that people spend at work, the quality of the building influences on the productivity, happiness and health of its users. The above must be considering during the decision making process of the construction or refurbishment for companies because it is possible to save up to 50% with employee retention and wellness and up to 9% with utility and maintenance savings [2].

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## **The pesticides present in the food of Brazilians**

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**Keywords:** Agrochemicals. Brazil. Health surveillance. Food and nutrition security.

### **ABSTRACT**

Brazil is the largest consumer of pesticides in the world, even though these poisons are responsible for several social, environmental and human health impacts. In the country, since 2001, there has been a monitoring of pesticide residues in food carried out by a program of the National Agency of Sanitary Surveillance - ANVISA, denominated PARA- Program of Analysis of Agrochemical Waste in Food. The program collects food samples on the market and analyzes them in laboratories using the multiresidues method. The objective this paper is to analyze the results of the PARA over the years (2001 - 2015). The methodology descriptive-analytical research, of a documentary nature, which used as a data source the reports available on ANVISA's, from which it was possible to identify the foods and active principles analyzed by the program, as well as the irregularities found. There is no standardization in the number of samples or number of active principles analyzed, which directly interferes with the results and the effectiveness of the PARA. In all the years of operation, the program analyzed a total of 25 different types of food and more than 30 thousand samples. The maximum active ingredients analyzed were 228 of the more than 500 active ingredients currently licensed in Brazil. The type of irregularity most found in the analyzed foods was the presence of active ingredients not authorized.

The average of irregular samples was 20%, and in some foods the average of irregular samples exceeded 80%. It was also possible to notice that many of the pesticides detected and authorized in Brazil are already banned in other countries, and the most commonly used agrochemical, glyphosate, is not analyzed by the PARA. The program is important to expose part of the problem of the use of pesticides in the country, however, its results do not reflect the real exposure to which Brazilians are submitted, since it hasn't analyzed as much as half of the active ingredients registered in the country and, in addition, several foods present in the Brazilian food routine are also not analyzed.

# Development of dry eye models to test a new treatment option for dry eye syndrome

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**Keywords:** dry eye disease, dry eye model

Dry eye is a multifactorial disease that affects the ocular surface and tear fluid [1]. Typical symptoms include foreign body sensation in the eye, burning, itching and photosensitivity [2]. The prevalence of dry eye is 5 to more than 35% depending on the age group [3]. In order to investigate the underlying pathomechanisms of the disease in preclinical trials and to test new treatment options, suitable models are needed to simulate the disease.

**Material and methods:** Establishment of porcine dry eye model: porcine eyes were received from a local abattoir and corneal explants were prepared. To establish the model the porcine corneas were incubated at 37°C and 30% humidity, while the controls were incubated at 37°C and 95% humidity, for 24 hours. Establishment of human corneal epithelium model: Mattek™ tissue was incubated at 37°C and 25% humidity for 1 hour and incubated at 37°C and 95% humidity for another 24h. The controls were untreated and incubated with 37°C and 95% humidity during the same time.

To evaluate the morphology of the tissue, hematoxylin eosin staining and periodic acid Schiff staining were performed. The mRNA and protein expression of inflammation markers (MMP1, MMP9, IL-1beta) were investigated in porcine corneas. Statistical analysis was performed using Graph Pad. T-test analysis was used for comparisons. Differences were considered to be significant at  $p < 0.05$ .

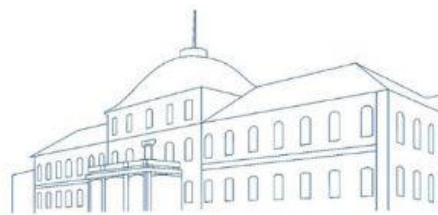
**Results:** The porcine corneas cultivated under high humidity were intact, whereas the ones cultivated under low humidity presented detachment of the superficial cells of the cornea. Analysis via qRT-PCR and ELISA showed an upregulation of the inflammatory markers IL-1beta, MMP1 and MMP9 in the low humidity groups. The human corneal 3D cell culture model was intact when it was untreated and the tissue was severely damaged when cultivated at low humidity.

**Conclusion:** Conditions to establish an ex vivo porcine cornea dry eye model were defined. Conditions to establish a human corneal epithelium model for dry eye were partially defined and a broader experiment is already on going. Both models can be used to test a new treatment options for dry eye disease.

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Abstracts

**Session A2**

**Biodiversity and ecosystems  
services**

# Gain of scale in the restoration of ecosystems in Brazil: can we handle it?

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**Keywords:** Public policy; Ecological restoration; Native species

## ABSTRACT

The Brazilian federal government has a plan to recompose native vegetation in Brazil with an ambitious goal: to reach 12 million hectares restored by 2030. However, there are a number of major challenges to achieve this goal: the change in the political landscape since the elections of 2018, state regulations, the lack of infrastructure for seed collection and production of seedlings, deficiencies in labor and skills, the lack of regulation of payment policies for environmental services, and the lack of interest from entrepreneurs with the existing possibilities for using timber and non-timber products, among others. Thus, the purpose of the presentation is to outline a brief scenario of these Brazilian challenges and how the public and private sectors, as well as nongovernmental organizations, have been seeking to overcome them in the various Brazilian biomes.

# **Integrating livestock production and rangeland conservation for a sustainable use of the Caatinga ecosystem**

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**Keywords:** sustainability, drought, adaptation strategy, small ruminants

## **ABSTRACT**

Extensive livestock production is an important livelihood strategy in the semi-arid NE Brazil. However, recent studies indicate that poor management, high stocking rates and exploitation of resources coupled with frequent droughts threaten the sustainability of the farming and eco-systems. In the frame of the BMBF-Research Program „Sustainable Land Management“, the “Innovate” project addressed the interplay and interdependencies among land management, climate change and ecosystems services.

This study aimed at revealing a) farmers’ and experts’ perceptions of livestock impacts on the vegetation and biodiversity of the Caatinga rangeland and b) adaptation strategies in order to co-develop measures for an improved management of natural resources.

Data collection methods comprised structured interviews with 135 small ruminant keepers and semi structured interviews with 10 experts from agricultural institutions and cooperatives.

Continued growth of the goat and sheep populations, despite of the drought in 2012 and 2013, indicate that small ruminant production is a drought-robust strategy for farmers. Average stocking rates of 3 to 5 goats per ha Caatinga and a general low feed supplementation level revealed excessive pressure on the vegetation. Farmers perceived that in the previous years the density and biodiversity in the Caatinga were either higher or much higher compared to the present (85% and 80%, respectively). Drought was perceived as main threat to Caatinga degradation followed by deforestation, whereas overgrazing was considered irrelevant by farmers. In contrast, 70% of experts perceived that extensive livestock production affects Caatinga degradation. While the majority of farmers did not suggest any Caatinga management strategies, experts proposed to improve grazing management, increase forage production and conservation, stop deforestation and establish Caatinga protection areas. As an outcome of project interventions, legal status of a Caatinga conservation area has been achieved.

It is recommended to adapt livestock stocking rates to specific conditions, considering the carrying capacity of the rangeland and the on-farm forage supply. Communication and collaboration among local stakeholders, scientists and policy makers need to be enhanced in order to develop site-adapted solutions, integrating livestock and forage strategies and ecosystem services for a sustainable land management.

# Large scale ecosystem restoration: The Araguaia Biodiversity Corridor by the Black Jaguar Foundation

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**Keywords:** Araguaia River, Biodiversity Corridor, Amazon, Cerrado, Brazil

## ABSTRACT

The Black Jaguar Foundation (BJF) pursues one clear objective: planting indigenous trees on a massive scale to help realize the Araguaia Biodiversity Corridor (ABC) in order to conserve biodiversity and to improve the lives locally and globally, now and for future generations.

The ABC in Central Brazil will become the longest biodiversity corridor on earth and one of South America's largest reforestation projects. With a total length of approximately 2,600km (same as Stuttgart-Alexandria) and a width of up to 40km situated alongside the riverbanks of the Araguaia River, the Corridor joins "natural habitat islands" and connects thereby two of the world's most vital ecosystems: Amazon and Cerrado.

The Corridor is being built based on the Brazilian Forest Code. Among others, this Code states that part (from 20 to 80%) of every rural private property in Brazil should be dedicated to preserving native vegetation. The BJF understands farmers as partners and develops agreements to restore the land not yet compliant with the Code.

If one hand this project is ambitious, on other it's feasible due to the cooperative approach. As the catalyzer and coordinator of the ecological restoration process, the BJF articulates the common interests of and supports synergies between a broad network of farmers, technical partners, local communities, supporters and universities.

A successful pilot project is being conducted by the foundation in three partner farms to demonstrate the viability for escalation in the coming years.

In order to better estimate the funds required to implement the project as well as to quantify the major ecosystem services and other the benefits, the BJF is running a Cost-Benefit Analysis for its project. This Analysis is being conducted and advised by a large and widely international consortium including scientists from renowned universities such as the University of Hohenheim, the University of São Paulo and the University of Illinois.

Due to the sheer dimension and complexity of the project, it will offer a huge potential for international research collaboration during decades to come. BJF is interested to deepen the understanding of the environmental and socioeconomic framework and thereby facilitate and accelerate the project's progress.

# Pedogeochemistry of Amazonas terra firme soil – 66 elements

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**Keywords:** oxisols, geochemical mapping, upland soil, land use

## ABSTRACT

Existing pedogeochemical data for Amazon basin soils are scarce; many important elements are either not covered or could not be quantified in the past. We present a comprehensive dataset from 29 sites, representing little disturbed forest and subsequent land use in Amazonas state, Brazil. TOP (0–20 cm) and BOT (30–50 cm) mineral soil were sampled in triplicate with manual augers as composites from at least one hectare each. Material < 2 mm was dried, sieved, and milled to analytical size (< 63 µm). Major and minor elements (WD-XRF with PPP and GFD, elemental analysis), minor and trace elements (ICP-OES, ICP-MS) as well as ultra-trace elements (ICP-MS, AAS) were quantified.

We present evidence for significant modification due to recent deforestation and post-forest land use on upland soils. Significant differences emerge in median element concentrations between these two land-cover types, and between central and southern parts of the basin. These new data are a product of the EcoRespira-Amazon project (<https://blogs.hrz.tu-freiberg.de/ecorespira/>).

Geological (lithological) and weathering boundary conditions define the primary soil chemical signal. This is overprinted by biogeochemical forces (ecosystem feedbacks) and recently at specific locations by human intervention (deforestation and land cover change). The general assumption of depleted tropical soils is not justified as such – a more differentiated view is needed, since macronutrients such as carbon and nitrogen, but also phosphorous do often occur in relatively high concentrations. Calcium, magnesium and potassium are truly depleted, albeit with noticeable dynamics. 47 determined trace elements show highly distinguishable responses. Most are relatively enriched albeit subtle in post-forest soils, a signal that is interpreted as a reduced plant-soil interaction signal. BOT concentrations are generally higher than those in TOP soil, reflecting weathering conditions – with important exceptions.

# Towards land degradation neutrality in vulnerable ecosystems: an inter- and transdisciplinary approach in the Brazilian Caatinga

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**Keywords:** tropical dry forest, plant diversity, carbon stocks, stakeholder involvement

The Caatinga is a species-rich, seasonal tropical dry forest ecosystem with high endemism rate and relevant carbon stocks. The region is also one of the most densely populated semi-arid areas of the world. This has resulted in substantial deforestation of the forest cover and pressure through crop-livestock farming and other uses of the land, putting the endemic and other adapted species at risk. There is comprehensive legislation for nature conservation, including the governance of natural resources. However, implementation is still in its infancy. The climate is characterized by a combination of high temperature, high potential evapotranspiration and erratic precipitation which results in low plant-available moisture during most of the year. Accordingly, the area has a high risk of degradation and subsequent desertification and a high vulnerability to climate change.

The German-Brazilian collaborative project INNOVATE aimed at exploring novel approaches for sustainable use of natural resources [1]. The model region was located north of the Itaparica Reservoir within the Sub-Middle section of the São Francisco River Basin in Pernambuco, Brazil. Our project intended to provide stakeholders on different levels with land-use solutions that (i) protect crucial ecosystems along with their functions and (ii) foster the resilience of the social-ecological systems towards negative impacts of climate change. Land degradation was considered based on land cover, productivity of agroecosystems, above- and belowground carbon stocks, and plant diversity. We assessed these indicators in relation to different intensities of grazing and irrigation farming. Tight stakeholder involvement at different institutional levels during all project phases was undertaken.

We analyzed gradients and different management options, implemented indicator development and monitoring, and derived suggestions for land-use adjustments [2,3]. We have worked with local and regional authorities, farmers, and conservation activists with whom we have jointly developed specific recommendations [4]. Such implementation activities seem promising to reduce the risks from degradation and vulnerability of the affected social-ecological systems to climate change. In summary, the project developed a comprehensive approach to the use of research to achieve land degradation neutrality and to address different stakeholders. Scientific backstopping supported development processes and provided decision-makers with sound and timely knowledge.

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## Impacts of recent land use on the fine-scale genetic structure of the endemic tree *Spondias tuberosa* Arr.

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**Keywords:** genetic diversity, spatial genetic structure, land-use types, umbuzeiro, Caatinga

### ABSTRACT

Genetic studies in tropical tree species have found signs of decreased genetic diversity and increased levels of inbreeding and spatial genetic structure (SGS) in fragmented and exploited populations. In Brazilian semiarid region, the endemic fruit-bearing tree *Spondias tuberosa* Arr. have a great socio-economic and environmental importance. This species is a source of sustenance for local people, as well as a food provider for wild and domesticated animals, playing an important role to environment. However, there is a lack of seedling recruitment in their natural environment, which has been attributed to several causes, including the land use change and overexploitation. Using seven microsatellite (SSR) markers, we investigated the fine-scale genetic structure in *S. tuberosa*. We genotyped 102 adult and 245 offspring individuals from different land-use types: abandoned areas, agricultural areas, degraded caatinga and preserved caatinga. We calculated the genetic diversity, number of migrants and the SGS. The genetic diversity was very low and showed no significant differences, neither between the land-use types nor between cohorts. The number of migrants was calculated according to the cohorts and it was higher in offspring individuals. A higher number of migrants indicates a constant gene flow between individuals. In *S. tuberosa*, this gene flow is due pollinators, as the seed dispersal by wild animals of this species are rare in the study area. Isolated trees are expected to receive fewer, but longer, pollinator visits. This can lead to inbreeding depression or even reproductive failure. In almost all land-use types the SGS showed significant differences between neighboring trees, growing at least 100 m apart. These results suggest that near neighbors within each land-use type are genetically related due to restricted seed dispersal. Our study highlights that *S. tuberosa* maintained low levels of genetic diversity, which wasn't influenced by the land-use types. However, the landscape fragmentation itself as a consequence of the land use may increase the inbreeding in anthropogenic areas. Based on the SGS of individuals of *S. tuberosa*, a general recommendation for conservation purposes is that seeds should be collected from trees at least 100 m apart to maintain the genetic diversity of *S. tuberosa*.

## Flowering pattern of epiphytic orchids in rainforests of the Planalto das Araucárias in Southern Brazil

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**Keywords:** epiphytic orchids, flowering time, Atlantic rainforest, Araucaria forest

The Orchidaceae family is one of the largest families of flowering plants with about 26.000 species distributed in 736 genera<sup>[1]</sup>. The plants of this family distribute throughout the world, while the epiphytic species are mainly found in tropical regions<sup>[2]</sup>. Around 400 orchid species belonging to 120 genera grow in different habitats of Rio Grande do Sul state, Brazil<sup>[3]</sup>. Their highest concentration is found in the eastern part of the state, in the remaining areas of the coastal plain of the Atlantic Rainforest and in the mountainous region the Araucaria forest<sup>[4]</sup>. The Centre of Research and Nature Protection Pró-Mata (CNPn Pró-Mata) is located within this region, which has a climate that favors the growth of epiphytic plants like orchids, due to frequent rain and fog events.

This study aimed the inventory and record the flowering time of the epiphytic orchids occurring in the study area. Seven transects within the CPCN-Pró-Mata were observed monthly during a period of 26 months from September 2000 to September 2002. Further observations were conducted in March-April 2017. Twenty two species of orchids were found in the study area, belonging to 15 genera: *Acianthera hygrophila*, *Acianthera sonderiana*, *Anathallis dryadum*, *Anathallis linearifolia*, *Brasiliorchis picta*, *Bulbophyllum glutinosum*, *Cattleya coccinea*, *Christensonella cogniauxiana*, *Epidendrum caldense*, *Gomesa* cf. *gravesiana*, *Gomesa concolor*, *Gomesa hookeri*, *Gomesa macronyx*, *Octomeria ochroleuca*, *Octomeria umbonulata*, *Pabstiella mirabilis*, *Phymatidium delicatulum*, *Pleurothallis bradei*, *Pleurothallis* sp., *Prosthechea bulbosa*, *Specklinia grobyi*, *Stelis* sp. The species from genus *Acianthera* flower from April to November, *Anathallis* from March to December, *Brasiliorchis* from April to November, *Bulbophyllum* from October to March, *Cattleya* from September to January, *Christensonella* from August to January, *Epidendrum* from March to May, *Gomesa* from September to April, *Octomeria* from March to April, *Pabstiella* from June to November, *Phymatidium* from March to May *Pleurothallis* from February to December, *Prosthechea* from August to October, *Specklinia* from August to December and *Stelis* from September to December. The results indicate that temporal splitting of flowering periods is an important mechanism for speciation of epiphytic orchids.

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# Responsible socioeconomic development in tune with nature: Exploring and embracing the biological diversity of Southern Amazonia

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**Keywords:** Conservation, Fungi, Amazonia, Biological Diversity, New Species

The Fundação Ecológica Cristalino (FEC) [1] was founded in 1999 and is situated in Alta Floresta, MT, working within the Southern Brazilian Amazon towards the protection of natural areas, social communication, education on conservation, scientific research and encouragement to develop a green economy. Funds are received through Ecotourism and are used to support research projects and education on conservation.

The **Cristalino Fungi Project**: Whereas the role of fungi in ecosystems is widely overlooked FEC initiated among other biological studies the Cristalino Fungi Project in a partnership with Micolab of Federal University of Santa Catarina (UFSC) to reduce the shortfall in knowledge of the Amazonian Funga. This pioneering project aims to achieve scientific evidence necessary for fungal conservation and to conduct taxonomical research. Additional educational activities and publications do multiply our outreach and strive to reconnect people with nature.

Since the beginning of the project in 2015 approximately 1700 fungi were photographically documented and GPSmapped. Students of the biological field trips of the University of Tübingen [2] contributed many pictures. 962 specimen were collected by collaborators of MICOLAB-UFSC and volunteers of the State University of Mato Grosso. The collection is hosted at FLOR Herbarium (UFSC) and is studied within research projects of MICOLAB-UFSC and Instituto Nacional de Pesquisas da Amazônia (INPA). Accompanying publications and the inclusion of fungi in the educational activities of our 'School of the Amazon' program has created a broad attention for the regions' outstanding biodiversity and its need for conservation.

A remarkable diversity of fungi with a great potential of discovery of new species for science has been found. At the same time a gap of sampling for Southern Amazonian Fungi is closed, a large number of the collected specimen constitute either a first record for the State of Mato Grosso, in some cases for the Brazilian Amazon or even Brazil. Lastly, our two Fungi Field Guides [3] [4] published at The Field Museum Chicago are considered the largest photographic resource of Amazonian Funga, which received international recognition by being awarded the 2017 Field Guides for Conservation Contest [5].

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# **Conservation of Private Reserves in BRAZIL: The example of the Cristalino Lodge in the Amazon**

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**Keywords:** Rio Cristalino, RPPN, pioneer in ecotourism

## **ABSTRACT**

The movement of private properties in Brazil in order to preserve part or their entire land started in 1965 onwards, in an initiative of land owners who did not want hunting in their property, especially in the State of Rio Grande do Sul. In 18 July 2000, through the Federal Law number 9.985/2000 the "National System of Conservation Units"(SNUC), included the private reserves in the category of full protection, the same one as a National or State Park, aiming the protection of the biological diversity. The System of Conservation Units in Brazil is formed by a set of federal, state and municipal laws and it encompasses private owners, non-governmental organizations (NGOs), individuals and legal entities. The Private Reserves are registered in perpetuity in the Public Registry of Real State. The activities allowed in a private reserve are scientific research, ecotourism and environmental education. The advancement of environmental laws, the modern concepts of ecological corridors and mosaics demonstrate that the obligation of environmental protection competes not only to the public sectors but also to the collective. It started with a small movement and up to June 2019 we have reached 1.563 RPPNs in Brazil, summing up 888.060 hectares and the aim is to reach one million hectares soon.

The Cristalino Lodge located in a private reserve in Southern Brazilian Amazon represents the first one in the State of Mato Grosso. It started with 700 hectares, increased to 4.732 hectares in 2015, with other 2.502 hectares in approval, encompasses more than 7.000 hectares by the Cristalino River. Other areas under protection by Da Rivas family form a huge block of almost 12.000 hectares by Teles Pires River, 20% bigger than the island of Manhattan in the USA.

The pioneer movement of the Cristalino Lodge and the Cristalino Foundation, of bringing scientists to the region, started to prove the biological diversity of the region, and its endemism, due to its location between the Xingu and the Tapajós rivers in the Southern Amazon. In 2000 the State of Mato Grosso declared the Cristalino State Park, encompassing further 184.900 hectares which surround the Cristalino Private Reserves.

# Conserving genetic diversity in progenies of open pollination of macaúba for commercial plantations and breeding

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**Keywords:** Genetic vulnerability, Sustainability, Acrocomia/palm breeding, molecular markers

## ABSTRACT

At present, intelligent and sustainable agriculture presupposes, among other attributes, a compromise between maximizing crop yield and minimizing its risk of genetic vulnerability. In this sense, breeding programs should implement strategies that allow the development of superior genotypes and preserve genetic variability, especially in the case of perennial plants. In the case of macaúba (*Acrocomia aculeata*), a species with a degree of insipient domestication, its vocation to supply oil with the same productive capacity as the oil palm, but can be cultivated in areas with water deficit, has been motivating its commercial interest and increasing the demand for seedlings for commercial plantations. In order to serve this prominent market, the IAC develops researches with the objective of providing commercial seedlings from superior trees of natural massives. To evaluate the impact of this selection procedure on the reduction of genetic variability and, consequently, increase the genetic vulnerability of commercial planting, the genetic diversity of open pollinated progenies (OPP) from selected matrices was analyzed in relation to the genetic diversity of respective native populations. Four populations were selected. From each natural population, 25 plants and 4 families of open pollination were analyzed, each family consisting of 18 individuals. The variability characterization was performed using the allelic variation provided by 10 microsatellite markers (EST-SSR). The number of alleles in the OPP ( $N_a = 97$ ) and polymorphism ( $P = 65\%$ ) was similar to that of native populations ( $N_a = 98$  and  $P = 72.5\%$ ). Likewise, mean values of expected heterozygosity ( $H_e$ ) between native populations and OPP were similar, with a mean of 0.28 and 0.32, respectively. The results show that there was no significant loss of the genetic diversity of OPPs derived from artificial selection within natural populations. The understanding of the dynamics of the macaúba genetic diversity under artificial selection indicates that this procedure adopted for the production of commercial seedlings should not offer a high risk of genetic vulnerability. In addition, it will guide breeders on selection intensity in both natural and improved populations for the advancement of generations with a view to maximizing future genetic gains and maintaining genetic diversity.



Abstracts

**Session B2**

**Forestry systems - renewable  
resources for growing demands**

# Bamboo: an alternative source of biomass for bioenergy

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**Keywords:** energy, moisture content, drying curve, dendroenergetic

## ABSTRACT

In Brazil, almost 8 million hectares of planted forest, mainly with *Eucalypt* produced more than 226 million of cubic meter of wood, reducing the national pressure over the native forest during the last 20 years. The size of the planted forest should increase up to 20% in the next 10 years and bamboo could be one of the newest crop to make more diverse the renewable energetic matrix. Its productivity is still below the genetic potential observed for *Eucalypt* clones, however, bamboo remains a crop without any large scale research program as *Eucalypt* had during the 1970's.

On the other hand, bamboo chips reviewed to dry faster than any other *Eucalypt* specie so it could be still a possible new bioenergy crop for the Brazilian farmers or clean biomass power plants. So far there is no record about pragues or diseases for bamboo crop in the field, situation that doesn't happen on *Eucalypt* plantations.

Some dendroenergetic characteristics will be presented comparing the *Bambusa vulgaris* x *Eucalyptus urophylla* after being evaluated those parameters: stem diameter and height, biomass production, gas exchange, and SPAD index.

# Applying circular economy principles in forest landscape restoration (FLR) to design out deforestation in Brazilian Biomes

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**Keywords:** Circular economy, inclusive bioeconomy, deforestation, restoration, nature based solutions

## ABSTRACT

In 2018, 12 million hectares of tropical forests disappeared worldwide <sup>[1]</sup>. Until 20 years ago, the Amazon Rainforest performed a very important environmental service of retaining CO<sub>2</sub>. Nowadays the forest can be considered carbon neutral <sup>[2]</sup>, with a high probability to turn into a degraded savannah if the deforestation rate exceeds 25% of its original area (current rate is about 17%) <sup>[3]</sup>. Brazil is by far the deforestation leader, mainly due to the deforestation-linked commodities, which are also affecting other biomes. On the other hand, there are massive land restoration opportunities, which are at the heart of natural based solutions to boost cost-effective CO<sub>2</sub> mitigation through 2030. This climate mitigation potential of forests is far higher than generally understood, and not reflected well in the NDCs under the Paris Agreement. The objective of this research is to propose a novel approach to forest restoration economy, a vision underpinned by circular economy principles, to halt deforestation in all Brazilian biomes. In order to offer a disruptive alternative to the historical pathways and the deforestation vicious cycle that Brazil is locked in, the study suggests an integrative framework to move from a linear model for ecosystem degradation and habitat conversions to a circular model for ecosystems restoration, enabling a long-term value creation through inclusive bioeconomy applied to ecosystem services, once the most affected stakeholders in the value chain – local communities – have to be included in the solution design. The research focus are the upstream activities, to bringing the links in the value chain closer together in order to achieve an effective upward and downward traceability. Additionally, a deep dive analysis of the effectiveness and mitigation potential of the promised restoration at a country level and companies deforestation pledges have significance for the main output of the study: a roadmap for private and public sector to promote value chain collaborations, contributing to the post-2020 progress of those commitments. These findings highlights that circularity can be an adaptation and a governance tool to secure the resilient of forests and its environmental services as well to address deforestation-free commodity supply chains, thriving communities.

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# Mapping of Agroforestry Systems in Rio Grande do Sul, Brazil

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**Keywords:** Agroforestry Systems; Atlantic Rainforest; family farming

## ABSTRACT

The present work is a result of a project of mapping agroforestry experiences in Rio Grande do Sul, Brazil. A total of 280 cases were identified. Twenty-four field trips were carried out in the production areas and a semi-structured questionnaire was applied on handling, processing and marketing. Tree farming is used by different farmer profiles: (i) large and medium-sized properties that engage pasture or crop consortia of species of interest to the forest industry; (ii) small farms that are descended from colonial agriculture of polycultures; (iii) Neo-rural granges, which do not necessarily survive the agricultural incomes, but which seek, in agroforestry, a link with nature and other forms of feeding themselves; (iv) lands of indigenous and traditional populations, which protect forestry fragments that are managed in a traditional way; and (v) agroforestry yards, which are present in the different property profiles, important for self-consumption and community exchanges. During those visits, 200 different species were found being managed, characterizing a diversified flora in agroforestry systems. The most frequent agricultural species were banana (*Musa paradisiaca*) and orange (*Citrus sinensis*). Exotic forest species were Eucalyptus (*Eucalyptus* sp.), Acacia (*Acacia* sp.) and oriental raisin tree (*Hovenia dulcis*). Among the native species of the Atlantic Forest are the fruit trees such as araçá (*Psidium cattleianum*), guava (*Psidium guajava*), guabiroba (*Campomanesia xanthocarpa*), gabijú (*Myrcianthes pungens*) and pitanga (*Eugenia uniflora*). There were also systems with yerba mate (*Ilex paraguariensis*), Brazilian pine (*Araucaria angustifolia*) and the juçara palm (*Euterpe edulis*). Among the species of multiple use, the most frequent species were red-cheek (*Schinus* sp.) Ingá (*Inga* sp.), Grandiuva (*Trema micrantha*), capororoca (*Myrsine umbellata*), and red angico (*Parapiptadenia rigida*). The interviewees point out to the feasibility of adopting agroforestry technology and the potential for income generation and conservation of resources in different regions. However, the diffusion of Agroforestry Systems depends on other factors that exacerbate agronomic knowledge and environmental conditions, of which farmers emphasize the relation with the licensing legislation for cutting, pruning and use of native species, besides the bureaucracy for processing agroforests products and for building markets and networks with other actors.

# Indigenous Schools Infrastructure in the Brazilian Tropical Forests

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**Keywords:** indigenous, infrastructure, education, sustainable development.

## ABSTRACT

Brazil has about 3.345 indigeneous schools and between the years of 2007 until 2015, resources have been given for the construction of 528 unities, however more than half of them have not been built, due the lack of planning and the difficulties to access remot areas. There are now 1022 schools that do not have their own facilities.

To solve this question, the federal government had launched a pilot project in the Amazonian region, in the indigenious reserves of the Alto Rio Negro. The access to this region is only made by the Rio Negro and its effluents. The methodology used was to make consultation to the participating communities, as recommended by the International Labor Organization convention 169 - Indigenous and Tribal Peoples Convention, 1989. Fifth places have been selected for the construction of schools, within the participation of 16 ethnical groups.

The school projects were conceived with the colaboration of communities representatives and they reach subjects about architecture, student population, usage of rainwater, photovoltaic panels and natural treatment of effluents. The conception and construction of schools have been divided in three fases, regarding the difficulty rate of access for the provision of building materials: the first, of easy access by the Rio Negro river throught all year, it includes 18 schools; the second, which the access is only possible in the rain period, due the navigability, it has 13 schools; and the third, where the access by river is impossible, those need to be built with resources produced locally, have 19 units.

In the architeturual conception, typologies have been defined considering the cultural tradition of the ethnicities involved in the project. In the areas of difficult access, specific construction systems will be developed .

The material used on the construction of the schools is, basically, the wood that is produced in the region, with the collaboration of the indians themselves. The wood selection is realized based on the studies of the Florestal Products Laboratory – LPF, which has a detailed study of 250 wood specimens of the Brazilian Amazon region.

As a result, we seek to align the project with the objectivies of the sustainable development in its three dimensions – economical, social and environmental – in an balanced and integrated form, giving a special attetion to the interest of the more vulnerable communities.

# DEFORESTATION IN THE AMAZON AREA

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**Keywords:** Deforestation moves, Amazon forest.

## ABSTRACT

Recent reports show that despite of intensive controls by government institutions using satélites and modern controlling equipment, the uncontrolled and illegal deforestation continues. Ground-controlling is insuficiente and fines can hardly be collected due to the fact that the wire-pullers often cannot be indentified and located.

It is questionable if foreign funds resolve these difficulties as long as the national government and the local administration does not reinforce the controlling and punishment.

Studies during a field trip in July 2019 will show the local situation in some parts of the State of Amazonas.

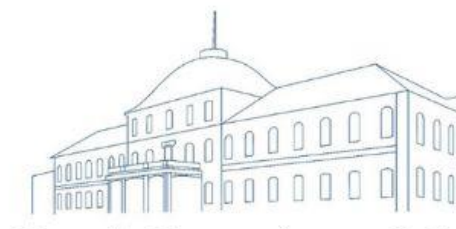
Referencies:

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Abstracts

**Session C2**

**Ethics for sustainable global  
change and healthy  
environment**

# On the values of biodiversity and sustainable development in the age of moral pluralism and extinction – ethical considerations

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**Keywords:** biodiversity, ethics, sustainable development, environmental politics

## ABSTRACT

The global situation regarding biodiversity and sustainable development seems to be paradox: On the one hand, many governments, science institutions, scientist, and civil society actors endorse the United Nation's Sustainable Development Goals (SDGs)[1] as well as the activities around the UN Convention on Biological Diversity (CBD) and the Intergovernmental Platform on Biodiversity and Ecosystem Services. On the other hand, not much progress has been achieved in improving the situation[2]. Why could species decline not be stopped regionally or globally? One possible answer is that biodiversity is still considered by many to be a seemingly 'soft' marginal issue, as is the whole of nature conservation. Yet at the same time, scientists have made lots of effort to develop economic instruments to earmark biodiversity and ecosystem with price tags in dollars or euros or addressed the significance for human well-being in a more general sense[3][4]. The values of biodiversity seem to be too weak and too strong at the same time. In this paper, first an ethical overview and analysis of the different values of biodiversity will be provided, and options will be discussed in the light of the moral pluralism. Yet beyond different value approaches, to secure biodiversity requires a comprehensive social transformation that affects land use, nutrition, consumption, mobility and much more. Protecting biodiversity is part of a comprehensive idea of Sustainable Development thus a socio-political task. The paper will hence explain environmental, ethical, and political aspects of a necessary transformation.

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# Study application of the LEED O+M certification in a Brazilian Airport Terminal

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**Keywords:** Environmental Certifications, LEED+OM, Airport Terminals.

## ABSTRACT

The discussions about sustainability and sustainable development have been taking place in several areas of society. One of them is the construction industry, where the responsibility of design engineers to implement measures to preserve natural resources in the construction and operation of buildings is latent and. The environmental certifications came with the intention of contributing to reduce the environmental impact generated by the projects, since the design, construction, remodeling and expansion, operation and maintenance phases of these buildings. This study performs an analysis of sustainability criteria based on the certification Leadership in Energy and Environmental Design (LEED) Operation and Maintenance [1] at the Lauro Carneiro de Loyola Airport Terminal [2] in Joinville. In order to carry out such analysis, four dimensions of the total of eight used by the certification were selected to evaluate and classify the projects, these are: Localization and Transportation, Sustainable Land, Materials and Resources and Internal Air Quality that were verified through required practices, prerequisites, and recommended practices, credits.. As a result, it is concluded that four prerequisites are obtained from the six possible ones, and nine points from the maximum of fifty, reaching the score of twenty points, the minimum necessary to obtain certification. This Certification comply with US and European regulations, not specifying parameters for the use of regulations and other equivalent national or regional environmental certifications as other countries. Thus, it is concluded that many of these evaluative parameters are in charge of the accredited professional auditor LEED. Both the Airport Terminal and the management company INFRAERO [3] follow mandatory sustainability policies and practices, as well as developing a new plan to be implemented in the coming years in order to improve the environmental performance of all the airports of its responsibility.

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# Circular economy and the fashion industry: the path towards sustainability?

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**Keywords:** fashion industry; circular economy; impacts; development strategies.

## ABSTRACT

The clothing production is a complex chain operating in a linear system that extracts resources, pollutes, emits greenhouse gas (GHG) and has negative impacts on social conditions (e.g. slavery, poor-paid jobs, degrading working conditions). By 2015, the global GHG emissions from the production of textiles reached the number of 1.2 billion tonnes of CO<sub>2</sub> equivalent<sup>[1]</sup>. Before even reaching the consumer, the production of clothing mainly starts with the raw material inputs, that can vary from plant-based fibers (e.g. cotton and silk) to synthetic polymers from oil (e.g. polyester). With the material in hand, the manufacturing process develop improvement actions, such spinning, knitting, bleaching, dyeing, apparel confection, with packaging, direct and indirect energy use, chemicals, and water use. Once the garment reaches the households, the environmental impacts are mostly identified by washing, drying and final disposal<sup>[2]</sup>. It is estimated than less than 1% of the material used in the textile production is recycled into new clothing. Circa 73% of the garments end up being landfilled or incinerated and 12% are recycled into other products. In the long run, the overall impact of the fashion industry does not tend to reduce, considering the increasing rates of population growth in the Global South and its demand for clothing – it is estimated that the total sales can reach 160 million tonnes in 2050 if the growth rates sustain. To tackle this foreseen reality, Circular Economy shows itself as an alternative development strategy for a sustainable shift in the fashion industry, in which the resources used to produce the garments are not wasted but return to the chain, acting also as a catalyzer for improvements of social conditions and quality of life<sup>[2]</sup>. This research will show, through scientific analysis, interviews and agencies reports, the application, opportunities and obstacles to apply the Circular Economy theory in the branch, recognizing its impacts in the human and natural environment and its capability to reinvent itself to reach overall goals of sustainability around the world.

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# Socio-economic structures of the artisanal small-scale mining sector of gold in the Amazonian Rainforest of Brazil

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**Keywords:** social, economic, artisanal small-scale mining, gold, Brazil

## ABSTRACT

Gold has a variety of applications like no other resource – used as capital investment, monetary reserves of banks, as jewelry or integrated in technologies. But its attention is also high in regards to ecological threats, social circumstances and economic aspects. [1] Artisanal small-scale mining (ASM) plays an important role - about 20% of the gold comes from this sector [2]. It serves as a livelihood for a lot of people, not only in Brazil [3]. One characteristic of ASM is its often informal and illegal structure [4], which is likely to hamper improvements for sustainable development. During field trips to the Tapajós Region in the Amazonian Rainforest of Brazil, primary data was collected by observations and with the help of narrative interviews. In order to understand the sector, a causal loop diagram reflecting the complex socio-economic situation with all its relations and interrelations between socio-economic factors was generated. The essence of this sector is based on autonomy, freedom and independence. Consequences of these attributes, often resulting in risks e.g. volatile earnings, can be deducted. This helps understanding the sector to be able to generate a basis for improvement.

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# German methodology, Brazilian practice: challenges implementing Plant-for-the-Planet in Brazil for teaching climate change

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**Keywords:** Sciences Education, Climate Education, Climate Change, Environmental Education; Forests

## ABSTRACT

In January 2007 the 9-years-old German boy Felix Finkbeiner presented a school project about the climate crisis. Inspired on the Kenyan Nobel Peace Prize, Wangari Maathai, he challenged his colleagues to plant one million trees [1]. Three years later, he was in the United Nations General Assembly calling all countries to take part of his movement which had already reached the goal to plant a million trees.

Since then, the Plant-for-the-Planet was born and has been operating as an international organization. It has created a methodology called Academies where children in many countries take part on a one-day workshop where they learn about climate change, its challenges and solutions. Plant-for-the-Planet arrived in Brazil in 2017 and, since then, has been organizing Academies in five different states of the country.

This project aims to investigate the contributions and disadvantages of this methodology to teach climate change for children in Brazil. If, on one hand, the Plant-for-the-Planet's method contributes to a Vision III [2] learning of Sciences in a country where education on climate change is very limited [3], on the other hand, this "made in Germany" method could be reproducing the Adorno's *Halbbildung* [4], where it ignores the particularities, such as children's socio-economic conditions and the forest and environmental diversity of the country.

During the research, 29 children and teenagers from 3 different cities were interviewed. From their answers, practical changes in Plant-for-the-Planet's methodology in Brazil are going to be proposed, based on an action-research approach [5].

The previous results show that in spite of learning about climate change, Brazilian children learned mainly about Finkbeiner's life's story. They also did not learn about trees in details and kept having difficulties, for example, to name native trees. Thus, the main conclusion is that adaptations in the methodology should be applied considering some singularities, but still using the basis and the story of Finkbeiner to inspire children in the learnings of the urgency of climate change.

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# Costs and Motivation – The two Psychological Determinants of the Water-Energy-Food-Nexus

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**Keywords:** Human motivation, Sustainable behavior, Psychology

## ABSTRACT

The reduction in energy and resource consumption is a topic that is widely discussed in society. Technological improvements do not always imply energy and resource savings, which emphasizes the importance of taking into consideration both the human factor in energy systems and the key role that people play in fulfilling the efficiency expectations placed in technological innovations. I depict the origin and rules of our sociotechnical system from an evolutionary perspective, considering basic human needs and motives. Shifting the focus from technology to human behavior, I explain the compensatory function of two core determinants of ecologically sustainable behavior in the sociotechnical system: a person's intrinsic motivation to behave sustainable and the costs that are imposed on an individual by these behaviors that often highly depend on available technology (Otto, Kaiser, & Arnold, 2014). In order to practically foster a sustainable energy and resource use, it is necessary to take both determinants (i.e., motivation and behavioral costs) into account. Most interventions address the costs of specific behaviors, because they can be manipulated rather effectively in the short term (Otto, Kibbe, Henn, Hentschke, & Kaiser, 2018). In contrast, the other, longer, but more sustainable road to fostering sustainable behavior would be to increase the motivation to behavior sustainable, because this motivation universally compensate for higher external costs. Nature-based environmental education, in particular, seems to be one promising road to increasing sustainability motivation (Otto & Pensini, 2017).

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# Possibilities for Sustainable Development in crushed stone mining

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**Keywords:** Sustainable Development Goals, crushed stone mining, environmental justice

## ABSTRACT

In 2015, the 17 Sustainable Development Goals (SDG) were launched by United Nations (UN) as part of an Agenda to be achieved by 2030. This research aims to discuss how crushed stone mining activity can be developed observing each one of the SDG. Three crushed stone mining industries, located in the region of Monsenhor Gil, Piauí, Brazil, were visited in order to follow the production process of the diabase mineral. Also, the environmental studies of these industries were accessed to analyse the environmental and mineral licensing process. It was observed the compliance with the SDGs related to the promotion of jobs (SDG 8), in contributing to the reduction of poverty (SDG 1) and hunger (SDG 2), besides the improvement of income for the community's residents, and the infrastructure of the environment (SDG 9). However, there are shortcomings such as the small number of women on the staff, setting up the disrespect for SDG 5, regarding the achievement of gender equality, as well as the lack of investments in inclusive education for employees and for residents of the region. Another point is that these industries do not recover the degraded areas, compromising the achievement of the SDG 13, regarding the combat of climate change and its impacts. In addition, if the visited industries left the place, it would cause great loss to the residents that depend on them for their jobs. Despite this, the research has shown that it is possible for the crushed stone mining activity to achieve each one of the SDG, promoting economic development allied to social and environmental justice.

# The potential of frugal innovation for sustainability transitions in Brazil

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**Keywords:** frugal innovation, sustainability transitions, Brazil

## ABSTRACT

*Introduction:* Frugal innovations focus on core functionalities, and are designed to best fulfil customers' needs in specific geographic contexts; especially in emerging economies, such as Brazil [1]. This focus on sufficiency allows for lower costs and the use of fewer resources. Besides creating accessible solutions to context-sensitive challenges, frugality aligns with calls for a complexity-reduced and more resource-conscious economy [2]. Brazil represents a promising supplier of frugal solutions; especially in the energy and recycling sectors [3]. This contribution aims to shed light on (1) the Brazilian context of frugal innovation and (2) its potentials in achieving sustainability transitions [4].

*Methods:* This study adopts an explorative and qualitative research design, due to the novelty of the topic. Case study research of frugal innovators in their geographic contexts is carried out, in order to develop an empirically grounded understanding of the idiosyncratic innovation properties in Brazil. Primary data from expert interviews has been collected between 2016–2018 in different cities in the South-East of Brazil; further secondary data from public documents enrich the primary data sources [5].

*Results and Conclusion:* This study focuses on successful examples of frugal innovation and outlines the trajectories of them as sustainability transitions. A multi-level perspective on socio-economic processes enabling the creation of frugal solutions is combined with a systemic and contextualizing understanding of innovation. Therefore a contribution to both innovation and transitions theory strands is made, by expanding the perspective on the agency level to the geography of sustainability transitions as well as by including the spatial perspective to the conceptualisation of frugal innovation literature streams [6].

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# Interactions between Nature and Society: The environment from a scholar geography perspective

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**Keywords:** nature and society, environment conscience, PCN

## ABSTRACT

Understand how is teaching the environment concept in the school can be a start point to construct the idea of sustainable development. The interaction between Nature and Society is central in the geographic debate over time. Geography emerged as a science to understand the environment, although this concept was approached in different perspectives [1]. How this relation Nature and Society is understood can broaden or not possibilities of understanding sustainable development, because the knowledge construction in the school is very relevant to the construction of an environment conscience [2]. In this way, the objective of this work is to analyze the approach of the environment concept in the Brazilian geography textbook.

To develop this research was necessary to review the concept of environment. To understand how the concept of environment is worked in Brazilian schools was analyzed the National Curriculum Parameter (PCN) [3], a base document used as a guideline for teaching in Brazil. In addition, to realize the analysis was selected two textbook collections, from the 6<sup>th</sup> grade to the 9<sup>th</sup> grade. In this collections the concept and the approach of environment was analyzed, and a comparison between the collections and the grade was made.

As a result, we observe the approach of environment in central both grades, but the scales are different. In the 6<sup>th</sup> and 7<sup>th</sup> grades the environment themes indicated by PCN are time of society and the Nature time; the natural phenomena, their regularity and the possibility of prediction by man; and the Nature and socio-environmental issues. In the 8<sup>th</sup> and 9<sup>th</sup> grades, the themes are the technical-economic process, the socio-environmental policy and problems; the socio-environmental dilemmas for food security; Brazil facing environmental issues; and environmentalism: thinking and acting. The PCN's propose is very pertinent to understand a broad diversity of Nature and Society relation, the relevant issues to think environment to sustainable development. However, the applicability of this proposal of PCN is not perfectly performed in textbooks. These books present a stereotyped view of the environment, revealing the relationship between Society and Nature and centralizing the discussion in the preservation of the environment.

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Abstracts

**Session A3**

**Water as a resource for  
sustainable development**

# **Water availability and quality threats in a Guarani Aquifer System outcrop zone**

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## **ABSTRACT**

The Guarani Aquifer System (GAS) is one of the most important transboundary aquifers in the world. Located in parts of four South America countries (Argentina, Brazil, Paraguay and Uruguay), its area is estimated to 1.2 Million km<sup>2</sup>. The GAS is formed by the eolian sandstones of the Jurassic (Botucatu formation) and fluvio-eolian Triassic (Pirambóia formation) periods. In Brazil 1,443 municipalities are located in the SAG area (BORGHETTI, 2004), with growing water demand for urban, industrial and agricultural purposes. Due to the strategic, social and economic importance of this aquifer for the four countries, it is necessary to understand its replenishment. The majority of recharge to the aquifer is hypothesized to occur in the outcrop areas, where the GAS appears as an unconfined aquifer. However few hydrogeologic studies focusing this question are available. The present project is compound of three major foci: 1. A monitoring network installed in the Ribeirão da Onça watershed aiming to understand and quantify the recharge mechanisms at these outcrop areas. A complete water balance can be evaluated, leading to the estimation of the main components of the hydrologic cycle (e.g., precipitation, evapotranspiration, storage, base flow) under agricultural use. The influence of different land uses (e.g. eucalyptus, sugar cane, citrus and grassland) can be quantified. 2. An experimental site under undisturbed dense Cerrado in order to understand pre-deforestation conditions. Canopy interception, throughfall, stemflow, surface runoff, erosion, and water table level are obtained, allowing the evaluation of the impact of soil use changes in comparison to native vegetation. 3. A monitoring network in an abandoned landfill aiming to the evaluation of contamination and transport processes in the Guarani Aquifer. Understanding the hydrological and contamination processes in detail scale is a key step in order to extrapolate local results to the whole aquifer system, providing reliable information for groundwater management and protection purposes.

the impact of soil use changes in comparison to native vegetation. 3. A monitoring network in an abandoned landfill aiming to the evaluation of contamination and transport processes in the Guarani Aquifer. Understanding the hydrological and contamination processes in detail scale is a key step in order to extrapolate local results to the whole aquifer system, providing reliable information for groundwater management and protection purposes.

# Water as a resource for sustainable development in Northeast-Brazil: insights from the INNOVATE project

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**Keywords:** São Francisco River, large dams, semi-arid, collaborative project

## ABSTRACT

Sustainable development is a multifaceted concept and today a declared pathway of many countries through the adoption of the United Nations Sustainable Development Goals. Freshwater is at the heart of goal 6 (clean water and sanitation) and is mentioned in the targets of several other goals. Since the goals are interrelated, understanding and accounting for their interlinkages is crucial for successfully reaching the goals. The sustainable water and land management of the semi-arid section of the São Francisco River Basin, a few decades after the construction of several large dams, is showing such complex development challenges.

An inter- and transdisciplinary approach is necessary to address the manifold development challenges and scientific knowledge gaps. The INNOVATE project was set up to this end [1]. It was a collaborative project in the Sustainable Land Management program of the German Ministry of Education and Research (BMBF), co-financed by the Brazilian Ministry of Science, Technology, Innovation and Communication (MCTIC) through the Council for Scientific and Technological Development (CNPq). The large bi-national consortium studied the aboveground water resources of the entire river basin, considering water quantity and quality issues, and focused on its Itaparica Reservoir, which is in the large semi-arid section of the basin.

The water from the reservoir is used, among other things, for electricity generation, domestic water supply, aquaculture and irrigation farming. Particularly in the case of increasingly frequent water shortages, the various uses compete with each other. Reservoir operation, water allocation and the management of the water and land resources require adequate decision-making systems at the relevant levels. The river basin committee is a novel actor representing several stakeholders, but it is not yet fully integrated into the existing decision-making structures [2]. Other major results of the project are [3,4]: the necessity for proactive management of the increasingly variable water availability, the timely establishment of adequate communication and monitoring systems of megaprojects, the consideration of water quantity-quality linkages in water quality management, adjusting water level fluctuations to mimic natural seasonal differences, and engaging in a dynamic governance process to promote a transparent and fair transition to sustainable water management.

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## **Sustainable limestone quarrying in water protection areas**

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**Keywords:** Water Management, Modeling, Karst Aquifers

### **ABSTRACT**

In the German state of Baden-Württemberg, limestones are mined in over 100 quarries. At the same time, these partially karstified formations are important aquifers for drinking water production. At a study area between Nagold and Tübingen, where approximately 200,000 people consume drinking water from karst and fractured aquifers, the potential risk of limestone quarries on drinking water abstraction was assessed at a planning level. Chemical investigations indicated the active limestone quarries currently do not influence the local drinking water supply. Using over 400 drilling logs and 9 geological maps (1:25,000), a three-dimensional geological implicit model was built and delivered important conceptual insights on how aquifer geometries and underground structures, including new postulated faults, influence the groundwater flow and the karst conduits development. Subsequently, numerical flow and advective transport modeling were carried out with MODFLOW to simulate the regional flow and the available tracer test data, as well as to estimate the capture zones and the water age of abstraction wells and springs. Finally, a GIS-based tool was developed to assist public authorities examining potential risks quarries extensions or new open pits can pose to drinking water supply.

# Water governance, water security and sustainability in Brazil

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**Keywords:** water governance, water security, Brazil, sustainability

## ABSTRACT

Even though benefitting from over 10% of the world's surface freshwater, Brazil nevertheless has undergone increasingly frequent water scarcity crises in both rural and urban areas. In 2014 a huge water crisis impacted the city of São Paulo (12,2M inhabitants) and threatened Rio de Janeiro (6,6M inhabitants). Three years later, water rationing regimes were adopted for more 850 cities, including the federal capital of Brasília (2.5M inhabitants), and for the first time for crops irrigated by the São Francisco River.

The work is developed according to a four-step methodology. First, the concept of water security is discussed based on a review of the literature, taking into account the sustainability criterion. The second step consists of an institutional analysis of water governance in Brazil, summarized from the perspective of water security, based on Brazilian regulations related to water; third, the recently launched National Water Safety Plan (April 2019) is discussed, taking into consideration (i) the results of the conceptual review, (ii) the institutional systems already in place related to water, analyzed under the federal arrangement perspective and (iii) innovative on-going initiatives related to water security at subnational level.

Conclusions highlight that important steps have been taken by the Brazilian federal government, such as recognizing the importance of water security in the federal government agenda, and acknowledging that it is incumbent upon the federal government to coordinate national strategies, perform structural water infrastructure works and estimate the order of magnitude of the requisite resources. But the federal government still does not have a water security policy *stricto sensu*: the Plan falls short in tackling aspects of water security and in considering intergovernmental relations established by the Federal Constitution (1988) on water regulation. These challenges should be faced, to be subsequently transformed into a sustainable and democratic policy proposal for national water security. The ongoing subnational initiatives reveal that there are manifold visions of water security in Brazilian society, still scantily known and disseminated. They should be more closely analyzed by all stakeholders for assessing the compatibility of the proposals with environmental stewardship and sustainability.

# Operation and adaption of a small self-sufficient wastewater treatment plant to the tropical regions of Brazil

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**Keywords:** Wastewater, wastewater treatment plant, solar energy, self-sufficient

## ABSTRACT

### Introduction

The northeast of Brazil presents the second worst wastewater infrastructure of the five regions of the country, with approximately 23.4% of its population being served by a wastewater network. This scenario is even more critical in rural areas, where less than 1% of the population has this kind of infrastructure (SNIS, 2016). The use of inadequate solutions for sewage management, especially rudimentary systems and alternative arrangements, has been causing the contamination of surface water and groundwater, as well as the risk of vector proliferation (COSTA et al. 2014). The search for solutions aimed at achieving universal sanitation in Brazil is one of the most important challenges in the coming years.

### Materials and methods

The aim of this work is to adapt a small wastewater treatment plant commonly used in Germany to the tropical climate in the northeast region of Brazil. The plant is powered by a renewable solar energy system with batteries and follows the concept of a SBR reactor with two separated tanks. The first one is for the denitrification and biological phosphorous removal and the second one for nitrification. The first part consists in the startup of the plant, where the aim was to guarantee the growth of the biomass. The second part was the evaluation and optimization phase, where samples of the main parameters were analyzed in order to verify the efficiency of the plant in the removal of carbon, nitrogen and phosphorous.

### Results and conclusions

It was observed that the biology was growing really fast related to the high water and wastewater temperatures. The adaption of the system occurred satisfactorily to the tropical climate. The only serious problem which turned out was the slow sedimentation of the activated sludge which could not be solved yet. The operation of the solar system hasn't shown a problem over a long period while summer but with the beginning of the rain season with its cloudy days it came to a short but total shutdown of the system. For a safe operation, new solutions need to be found at least for buffering 3 cloudy days in a row.

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# Impacts of the critical climatic periods on water multiple uses in the Rio Pajeú watershed, Brazilian semiarid

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**Keywords:** extreme events, climatic variability, semiarid

## ABSTRACT

The frequency of extreme precipitation events has increased in recent years, with greater intensity and duration, and thus favoring natural disasters such as floods and severe droughts. The expansion of knowledge about the temporal and spatial variability of extreme events is of paramount importance for the climatic conditions of a given region. Given this scenario, the study aims to evaluate the impacts on water and soil use in face of critical climatic events in the Pajeú River Basin from the Standardized Precipitation Index (SPI). The identification of the critical climatic periods was made from the standardized Precipitation index (SPI). Monthly precipitated totals were used in the study from 6 pluviometric posts for a period of 44 years (1970-2014). After data acquisition, a preliminary analysis was performed to verify the occurrence of failures and inconsistencies in the series of rainfall stations and Thiessen polygons method was applied to obtain the basin's average rainfall.

The confirmation that water resources in the Rio Pajeú watershed are very vulnerable to climate change becomes evident by the amount of droughts identified in the moderately dry category. Although not so intense, it indicates a tendency of water scarcity, considering that global-scale phenomena, such as *El Niño*, can reduce the performance of regional meteorological systems. In addition, it was found that water deficit coupled with high evapotranspiration rates have been negatively impacted in sectors such as agriculture, water supply, electricity generation, aquaculture, among other required multiple uses. Similiary results were found by Marengo et al. [1], Lacerda et al. [2] and Assis et al. [3] Soares & Nóbrega [4] affirm that the microregion of Pajeú is becoming drier, however, the rains, in this area, are becoming more concentrated, and the dry periods that are higher are intercalated between these episodes of rain. Based on the obtained results, it was observed that despite the existence of wetter years, there was a negative trend of precipitation during the studied period, especially between 1993 and 2013, when the dry years began to predominate. Consequently, Pajeú watershed will be drier and susceptible to erosion, affecting agriculture, livestock, electricity generation and population.

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## Turnover of pollutants at the catchment scale

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**Keywords:** groundwater, nitrate, degradation

### ABSTRACT

Anthropogenic organic and inorganic compounds nowadays occur ubiquitous in soils, surface waters and groundwater. Emission of many pollutants is ongoing (through wastewater, agriculture, traffic, households, industry) but still the long-term fate of many compounds in the environment is unclear. Some are degraded by microorganisms, others accumulate in soils or biota, enter the food chain or are transported into groundwater systems and finally may occur in drinking water. Although much progress was made during the last 20 years concerning the identification and parameterization of many processes in laboratory experiments their interplay and efficiency at field scale is not clear. Very slow, but essential processes may have been overlooked - biodegradation may be very different in the lab compared to the field. Solute turnover is believed to happen along steep biogeochemical gradients (locally small diffusion/dispersion coefficients) which are not well known under field conditions and which may dynamically shift their location depending on hydrology causing corresponding changes in concentrations.

This study discusses exemplary nitrate turnover in two different geological settings, i) a shallow floodplain aquifer and ii) a fractured limestone aquifer using reactive transport modelling along cross sections. A fully coupled geochemical model (MIN3P) is used to identify reactive zones and minerals [1, 2]. Results show that the geochemistry of the subsurface environment together with sufficient residence time is essential in nitrate turnover and may provide long-term risk reduction in groundwater pollution.

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# Planning, participation and sustainable water use to produce electricity in rural communities in Brazil

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**Keywords:** Rural electrification, sustainable water resource, participation

## ABSTRACT

### Introduction

Due to its large share of big and centralized hydropower plants Brazil is known for its „clean electricity production“. However, despite these major projects, ca. 800,000 (IBGE,2010)<sup>1</sup> citizens still have no access to electricity. The most of these live in rural areas. This work examines which planning processes are necessary to use decentralized small hydropower plants for generating electricity to supply small communities in rural areas. The study is based on the analysis and identification of the water potential in areas with a large proportion of people cut off from the public power grid, evaluates the current socio-economic situation in pre-selected locations and analyses requirements for planning methods.

### Materials and methods

The selection of the study areas was based on a GIS-supported analysis using data from various sources of national and federal authorities and employing multiple selection criteria such as hydrology, population and infrastructure. The appraisal of the current situation is founded on research with local authorities, expert discussions and targeted interviews with affected citizens in rural settlements. These three exemplary communities Ponte de Barro, Cachoeira Rica-Acorá and Serrinha are all located in the Mato Grosso State. In these previously selected municipalities, interviews were conducted with citizens and experts such as mayors or officers responsible for electrification. The interviews were transcribed and evaluated in a structured manner using MAXQDA software and analysed through the content analysis (Kuckartz, 2016)<sup>2</sup>.

### Results

The results of the evaluation reveal important elements that should be taken into account in planning: the need for comprehensive and target-group-specific information as well as the participation of the population, the organisation of those affected and the importance of sufficient technical support.

### Conclusions

The study was able to show which elements are relevant for the planning process and how the consideration thereof could be optimised further. From the results, suggestions for improvement of the planning procedure can be derived and the planning tools for sustainable water use by small hydropower in Brazil can be further developed.

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# Development of a lumped hydrological model for reasonable, long-term predictions of groundwater storage

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**Keywords:** Water management, long term water balance, uncertainty quantification.

## ABSTRACT

Sustainable groundwater management requires accurate long-term prediction of aquifer water budgets. Understanding of complex hydrological processes and water management processes is a key factor for sustainable groundwater management. Therefore, to predict a long-term aquifer storage, hydrological models need to be combined with water management models and extended by dedicated groundwater process. Such a modeling system needs to be feasibly fast and has to be lean on data requirement. Otherwise, it is not possible to make such a predictions far into the future with realistic data demand, and with honest uncertainty quantification.

Currently, we are working to produce a demonstrator case: the Wairau catchment in New Zealand, for testing our proposed modelling strategy. Poor understanding of recharge mechanisms and hence declining of groundwater levels is the major hindrance for sustainable groundwater management in our study area. To avoid problems with unavailability of data in a first proof of concept, we chose to build a virtual reality as reference with a MODFLOW- based model. In this way, we will try to calibrate as well as validate the lumped hydrological model extended by aquifer storage and by water management. As a future step, we will deal with obtaining proxies for aquifer data.

## Surfactant seed coating; toxic or beneficial?

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**Keywords:** surfactant, seed coating, germination

### ABSTRACT

Surfactants are often used in seed coatings to homogenise seed size and to protect seeds from injuries. Nonionic soil surfactant formulations based on ethylene oxide-propylene oxide (EO/PO) block copolymers are commonly used to increase root-zone water reserves in water repellent soils. Therefore the potential toxicity or beneficial of one Alkyl polyglycoside – EO/PO Block Copolymer Surfactant on onion (*Allium fistulosum* L.), Radish (*Raphanus raphanistrum* subsp. *Sativus*) and lettuce (*Lactuca sativa*) seeds was evaluated. This non-ionic surfactant was tested at 0, 0.125, 0.25, 0.5, 1.0, 1.5 g of product/Kg of seed with comparison of uncoated seeds. Seed germination was measured. In general, the highest surfactant concentration decreased seed germination. 1.0 g of surfactant/Kg of seed was the recommended concentration for onion, radish and lettuce seed coating.

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Abstracts

**Session B3**

**Minor crops and their  
importance for bioeconomy**

# Silvopastoral system with macauba palm: a bioeconomic option for south central Brazil

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**Keywords:** *Acrocomia aculeata*, Neotropics, Sustainability, Biofuels, Food, Landscape transformation

## ABSTRACT

Greenhouse gas emissions from agriculture, forestry and fishing have almost doubled over the last 50 years and by 2050 this volume is expected to grow by 30% if the sector's expansion is not reduced, according to the FAO report <sup>[1]</sup>. Part of the solutions to greenhouse gas mitigation converge both to reduce emissions and to sequester excess CO<sub>2</sub>. Thus, an important contribution to this problem is in the cultivation of forests. Furthermore, considering the importance of livestock and the expressive area occupied that represents about 158 millions of hectares in Brazil <sup>[2]</sup>, the adoption of silvopastoral systems is in line with the sustainable agriculture we seek to develop. In this context, we present the macaúba palm, a neotropical species that occurs spontaneously in pastures of the Brazilian savanas (cerrados). The average annual fruit yield per plant is 78 kg. Considering a density of 320 macaúba plants in the silvipastoral system, one hectare can produce 25 tons of fruits. This represents 3 tons of pulp oil (high oleic), 0.54 tons of kernel oil (high lauric), 4.3 tons of pulp cake (high soluble fiber), 0.3 tons of kernel cake (high protein) and 3.2 of endocarp (high lignin)<sup>[3]</sup>. Brazil currently allocates 5.3 billion liters of biodiesel to meet its commitment to reduce oil diesel consumption (B10 or 10% blend). In other words, Brazil would need to implement slightly more than one percent of its pasture area (ie 1.7 million hectares) in the silvopastoral system with macauba for the production of biodiesel consumed today. However, 918 tons of almond oil, 7.3 million tons of pulp cake, 510 tons of kernel cake or 5.4 million tons of endocarp would also be produced. Besides these numbers, would it be acting in the sequestration of atmospheric CO<sub>2</sub>, recovering degraded soils, increasing the organic fraction and the microbiology of the soil and offering greater comfort to the animals, without harming the development of graminea. Therefore, the macaúba palm presents bioeconomic values capable of contributing to an agriculture that combines innovation and sustainability.

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# Plant genetic resource and bioeconomy: Are we moving in the right direction?

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**Keywords:** Biodiversity, Neotropics, human impact, minor crops, transformation

## ABSTRACT

Since the dawn of mankind, people explore the cornucopia of the plant kingdom to obtain food, feed, fuel and fiber. Some thousand years ago man used approximately 7000 plant species for these purposes. Many of them vanished already, whereas others have become minor crops or even major crops. Wheat, maize, rice, and potatoes alone provide 95% of our daily caloric intake, while the African oil palm and soybeans together provide more than 50% of the vegetable oil demand [1]. Their growing demand currently puts very strong pressure on our planet as the extension of their production area adversely affects important sites of bio-diversity. It is almost high noon and time to make a change as planetary boundaries, particularly for ecosystem services such as biodiversity, are surpassed. Anthropogenic influences altered our biomes strongly. The area of untouched terrestrial biosphere has halved since the industrial revolution and only less than 20% of the earth' surface still faces low impact by agriculture or settlements [2]. This poses a tremendous pressure not only on our planet in general but also on sensitive biomes such as tropical forests and biodiversity hotspots specifically [3].

A strong shift towards sustainability is required if we really want to sustain our planet for future generations. A better valuation of environmental services such as biodiversity may provide a basis for sustaining biodiversity hotspots and their intrinsic role for human wellbeing. Plant genetic resources can supply raw materials such as oils, fibres and dyes and support the development of bioeconomies. Examples from the Neotropics are fibre crops such as curauá and Amazon kapok but also macaw palm and other species from drier environments.

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## Carotenoids variability in the Brazilian germplasm collection of macauba palm, *Acrocomia* sp.

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**Keywords:** Breeding, visual attribute, oil crop, minor crop,  $\beta$ -carotene

### ABSTRACT

The macauba (*Acrocomia* sp.) oil is of great nutritional value because of the functional biomolecules present in it, with carotenoids standing out [1]. These molecules have antioxidant and pro-vitamin A activities and can be used as food fortification element. In this study several macauba plants established in the Macauba Germplasm Bank of the Federal University of Viçosa, Brazil were characterized for the carotenoids content in the pulp oil. Mature fruits from accessions of São Paulo-SP, Mato Grosso do Sul-MS, Minas Gerais-MG, Pará-PA, Pernambuco-PE and Paraíba-PB were harvested and processed after 10 days storage in room temperature.

After depulping and drying, the pulp oil was extracted using a bench helicoidal pressing machine. Total carotenoid in the oil was quantified according to Rodriguez-Amaya [2] and expressed as  $\beta$ -carotene equivalent. The carotenoids content ranged from 27.89  $\mu\text{g}\cdot\text{g}^{-1}$  (MG) to 2595.12  $\mu\text{g}\cdot\text{g}^{-1}$  (MS). Accessions from PA showed inferior concentrations of carotenoids ( $\leq 63.24 \mu\text{g}\cdot\text{g}^{-1}$ ), opposed to most of MS accessions, which consistently presented higher values of carotenoids ( $\geq 370 \mu\text{g}\cdot\text{g}^{-1}$ ). Except for one plant from MG, which contained 439.09  $\mu\text{g}\cdot\text{g}^{-1}$  of carotenoids, all other accessions/provenances (SP, MG, PE and PB) produced less than 370  $\mu\text{g}\cdot\text{g}^{-1}$  of carotenoids. A parallel was noted between the carotenoids content and the color of the oil. Oils with higher carotenoids content, i.e. MS accessions, displayed reddish color whereas those from PA showed light green tones. Accessions from other states showed oil colors ranging from light yellow to orange, reflecting the great phenotypic variability of the plants from these regions. In conclusion, macauba pulp oil has wide variability regarding its carotenoids content and organoleptic traits. Accessions from MS have great potential in a selection program for this character.

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# Competitiveness of Two Macauba Productive Chains in Brazil

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**Keywords:** Acrocomia; Family Farming; Sustainability; Vegetable oils

## ABSTRACT

Macaúba (*Acrocomia Spp*), an oil palm native to tropical America, has potential for cultivation in large-scale crop-livestock-forest systems to provide environmental services, products and coproducts such as food, biofuels, cosmetics and oleochemicals<sup>1</sup>. Nowadays, its exploitation is mainly by extractivism, delivering interesting products only in a small scale. In this study we used strategic analysis<sup>2</sup> to evaluate the competitiveness of two macauba productive chains located in different Brazilian biomes, Semi-arid and Cerrado. It was based on face-to-face interview with key players in each area, i.e. extractivists, associations, cooperatives, academy members and technicians. In the Semi-arid, exploitation is more incipient and with a lower level of organization. It occurs mainly in an individualized way for subsistence, in association with the exploitation of babassu palm (*Attalea speciosa*). Fresh fruits are mainly delivered in bulk to intermediaries. Processing is rudimentary. On the other hand, there is a better-structured productive chain in the Cerrado biome, despite the extractivism as well. Here, collectors organize themselves in association and cooperative, and manage higher incomes due to the absence of intermediaries. Processing facilities are in place, using machinery developed locally. Fruits are processed into oils, cakes, soaps and endocarp, adding value to the productive chain. Government and non-government agencies are more active in this region. In common, both regions share no standard practices for handling, processing and product quality assurance. Although they are at different levels of development, both regions need transference of novel knowledge on macauba production and processing technologies, as well as establishment of public-private projects that may consolidate the productive chain of this promising crop.

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1 Plath, Mirco, Christine Moser, Rob Bailis, Patric Brandt, Heidi Hirsch, Alexandra-Maria Klein, David Walmsley, and Henrik von Wehrden. "A novel bioenergy feedstock in Latin America? Cultivation potential of *Acrocomia aculeata* under current and future climate conditions". *Biomass and Bioenergy* 91 (2016): 186-195.

2 Hill, T., & Westbrook, R. (1997). SWOT analysis: it's time for a product recall. *Long range planning*, 30(1), 46-52.

# Hemp as a multifunctional alternative: the case of the Quilombola communities of the Brazilian Sertão

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**Keywords:** Quilombolas, Cannabis, Hemp, Alternative food trends, Sertão

## ABSTRACT

This piece aims at exploring the potential capacity of the landscapes in the São Francisco river valley, Brazil, to provide industrial hemp products (seeds, leaves, fibers) to a growing global demand and potential local market in Brazil (food, cosmetics, industrial) through the empowerment of alternative trends and food labels in traditional Quilombola communities, countering environmental degradation and social marginalization. The São Francisco river valley, is the main agricultural landscape of the Brazilian *Sertão* region - an area subject to droughts, food insecurity and social inequalities - but is also the biggest producer of narcotic cannabis in Brazil. Traditional communities living here, such as the indigenous groups and Quilombolas - historically subjected to racism, poverty and land confiscation - often join the traffic networking and crop narcotic cannabis for subsistence matters. Thus being exposed to police persecution and violence. In addition, the predatory effects of agribusiness in the region made smallholder farmers living in Quilombola communities suffer threats to their productive resources, therefore hindering their alternatives. But cannabis is also a multifunctional crop, drought tolerant, used for centuries to provide mankind nutrition, textiles and medicine. Recently we have seen a relaxation of social stigma and consequent change in legislation, showing a growing global trend towards de-penalization and market regulation of this crop, together with a growing demand of ethical and sustainable alternative products, all of which is pushing the discussion towards regulation and marketization of cannabis products for industrial hemp, medicinal and recreational matters in Brazil. This would represent a way out of the illegal market for these populations, but political and market conditions might be a hindrance for them. The chance represented by newly established geographical indications such as the 'Selo Origens Brasil', which are valorizing and fostering sustainable agricultural practices of traditional communities, can provide added value and access to markets to marginalized communities and their products, among which hemp represent an ideal candidate, empowering these rural communities to overcome a current social problem, securing livelihoods and sustainable management of landscapes. The study was based on a participatory observational qualitative research with seven Quilombola communities in the presented region.

# Interaction between the family farm's livelihood production and socio economic sustainability, a study case in Brazil

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**Keywords:** Family farm, AD-AS, Sustainable Development

## ABSTRACT

The aim of the present article is to analyze, explain and emphasize the conditioning factors of the family farms of the micro basin of Barracão dos Mendes, in Nova Friburgo city, State of Rio de Janeiro, Brazil. The idea is to demonstrate how the agriculture based in small producers can be profitable - consequence of a great productivity - and also generates fewer environmental impacts, by using less energy, agrototoxin, and promoting less deforestation comparing to the agribusiness (Woodhouse, 2010). Furthermore the study introduce arguments in favor of the family farms, containing discussions related to the local social economic situation (especially when in comparison to the big farmers), as well as, the promotion of a better income distribution and the characteristic to avoid rural exodus.

Using the methodology of Analysis-Diagnosis of Agrarian Systems (AD-AS) (Dufumier, 2010), the fieldwork data were collected in February, July and December of 2018 applying 41 questionnaires. Was possible identify four production systems: "Leaf Vegetable", Vegetables, Fruit and Umbelliferous, these systems were compared among five types of producers: Owners, Sharecroppers, Family Farmers and Rural Entrepreneurs. The second step was the estimation of 3 variables by type of producer: 1. The generated aggregate value; 2. The agricultural income; 3. The potential for generating income per unit of labor. The results suggest that the family farm is an economic sustainable and productive activity for the studied micro region.

Therefore, considering the aggregate level, small producers can supply large demand of food, with fewer environment impacts and produce better social and economics results, even in developing country. The idea that only the agribusiness can generate sustained income is confronted by the present research; family farms activity can guarantee the livelihood of a large number of families and develop the rural area in developing countries, providing income distribution and their poverty relief (Guanziroli et al., 2001)

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## Financial analysis of the production of shimeji mushroom (*Pleurotus sajor*) in southeastern Brazil

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**Keywords:** Investment, fungiculture, implantation, environmental impact.

The consumption of mushrooms in the country expanded with the growth of colonies (Chinese, Japanese and Korean). The restaurant is the main factor of this growing consumption of shimeji mushrooms in Brazil. This market corresponds to €31.15 billion worldwide each year, with growth rates expected to reach 9% by 2021 [1]. The study aimed to evaluate the investments made in shimeji production. The Sítio do Vale Agroecologia, located on the Elias Alves road, km 2.5 in the city of Botucatu, state of São Paulo, Brazil, is a company producing shimeji mushrooms (*Pleurotus sajor*), distributed directly to the restaurants and retail of the city of Botucatu/SP, which adopts a sustainable cultivation process with the use of agricultural residues in its process and the reuse of the substrate as source. The amount of investments in this production was €5.709,47 which resulted in the total production of mushrooms of about 1000 kg per month, sold for €3.65 per kg, resulting in a gross profit of €3.654,06. Expenditure on energy, fuel, freight and supplier is around €2.28 per kg, resulting in a total profit of €1.37 per kg and €1.370,27 per month. It was verified that the investment of €5.709,47 was paid after the first 4 months of production, that is, a quick return investment, profitable and with good prospects in the face of a demand higher than supply in the domestic market and an expansion in the consumption of mushrooms in Brazil [2], which has an annual average of only 160 g, below European countries, such as Germany, which consumes 4 kg [3]. Therefore, there is viability of the project due to the increasing potential of consumption in Brazil, low implementation costs, and an investment in processes that involve the reduction of environmental impacts.

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## Evaluation of Shimeji Mushroom Production Process (*Pleurotus sajor*): a study case from Brazil

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**Keywords:** Fungiculture, residues, sustainability, agroecology.

### ABSTRACT

The growth of Brazilian market for edible mushrooms is expanding increasingly. The import of mushrooms from China grew more than 600% between 2008 and 2013 [1]. Mushrooms can be produced by 2 methods: (i) lignocellulosic substrates and (ii) woody substrates [2]. This study analyzed the stages of the local production process of shimeji mushroom produced from lignocellulosic biomass sources. The work was evaluated through an interview with a producer. The cultivated mushroom is the shimeji (*Pleurotus sajor*), in the city of Botucatu, in the interior of São Paulo, Elias Alves road, km 2.5 in a company called *Sítio do Vale Agroecologia*, which started its production in February 2016. The method used called axênico consists in two phases: (i) colonization of mycelium and (ii) growth. In the first phase of production the company has a shed with capacity to store 1000 bags, where the process is initiated for the duration of 15 days before going to the four greenhouses with a capacity of 400 dark bags in each greenhouse. The substrates used in the process of this company are: (i) wheat bran, (ii) sugarcane bagasse and (iii) brachiaria grass, sources easily found in the region. The amount consumed by the fungi is 5 kg of sterilized biomass for each bag, producing approximately 20%, depending on the climate, resulting in 1 kg to 1.2 kg of mushrooms. The biomass is placed in the dark bag and inoculated with the mushroom seed harvested from sorghum or corn. The cycle of each greenhouse is 30 days, germinate in 5 days and have a flow of 2 days. The substrates are discarded after 30 days on a farm where a producer of vegetables uses the material for fertilizer. It was possible to verify that the stages of the process such as the use of wheat meal, sugarcane bagasse and *brachiaria* grass for mushroom production, as well as the reuse of residues as organic fertilizers, maximizes the use of renewable sources for food production. Therefore, the edible mushrooms have presented their importance for enabling the economic recycling of agricultural and agroindustrial residues.

[1] ANPC. (2018). Cogumelos. Associação Nacional dos produtores de cogumelo. Retrieved on [04/02/19] from <https://www.anpccogumelos.org/cogumelos>.

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## Sole vs. mixed cropping – what are suitable cropping options for macaw palm?

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**Keywords:** Agroforestry, bioeconomy, climate change mitigation, sustainable land use, surrogate for palm oil

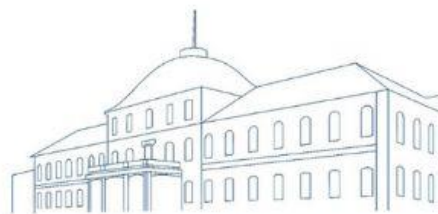
### ABSTRACT

Macaw palm (*Acrocomia* sp.), endemic to the Brazilian cerrado, is a neotropical species with an excellent bio-economic potential. Macaw palm gained a lot of interest in recent years, because it is not competing with rainforest and fertile land and therefore a sustainable alternative to the African oil palm (*Elaeis guineensis*). The oils from fruit pulp and kernel, increased the importance of macaw palm because of their high nutritive value but also as source of biofuels. It grows under a wide range of climatic conditions, from subtropical to tropical regions. Macaw palm has a great potential for integration into silvopastoral and agrosilvicultural systems.

The aim of this study was to investigate (i) if macaw palm is suitable for integration into agroforestry and/or silvopastoral systems (ii) which spacing of the palm trees guarantees the best light conditions for such systems. Microclimate and light interception of *A. aculeata* were measured in three systems (alley cropped with coffee, a silvopastoral system and a sole stand) in the Zona de Mata region of Minas Gerais, Brazil.

Isotope discrimination was used as an indicator for water stress. The measured  $\delta^{13}\text{C}$  values of coffee under shade trees or macaw palms were around the usual  $-28\text{‰}$  for C3 plants, but under full sun, coffee's  $\delta^{13}\text{C}$  ranged between  $-26$  and  $-27\text{‰}$ , indicating slight water stress. Air temperature, relative humidity and soil temperature fluctuations were lower in the intercropped plots than in the full sun coffee plots. The maximum PAR increased with spacing from 540 to 1333  $\mu\text{mol m}^{-2}\text{s}^{-1}$  in the 5 m by 4 m and 7 m by 4 m plot, respectively, allowing to grow other crops in between.

Macaw palm coffee intercropping and macaw palm silvopastoral systems can be considered a viable mitigation option for regions with climate change impact as it provides a prolonged harvesting window and a more diversified income for farmers. By integrating macaw palm lots into pastures, C4 grasses can establish in between and shade areas for cattle are provided – a win-win situation for cattle raising without compromising macaw palm growth.



Abstracts

**Session C3**

**Migration and communication  
(Socio-dynamics)**

# **Necropolitics of migration: Thesis on the darker side of Globalization**

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**Keywords:** Necropolitics, Sovereignty, nation state, globalization, inequality

## **ABSTRACT**

The increasing mobility of people across national borders might not be a new topic but has indeed become more critical over the past decade. According to the Migration Policy Institute, Europe faced its worst refugee crisis since the Second World War whereas data from the UN shows that in 2016 “nearly 5.2 million refugees and migrants reached European shores” (UNHCR, 2019). Such an acute situation led to the popularization of the discussion on what has been broadly described as “Europe’s refugee crisis”. These impressive figures, however, have an even darker side. According to the Missing Migrants Project, over five thousand migrants died or went missing in the Mediterranean during the year of 2016. Even more significantly, some were left to die in the sea (Forensic Architecture 2019). Departing from the notions of Necropolitics, coined by Achille Mbembe (2003), and expulsion (Sassen 2014), this proposal will focus on the deaths in the Mediterranean Sea during the period from 2015 to 2018. More specifically, the work investigates the relationship between the rise of inequality in the global stage, the toughening of migration policy in Europe and an increasing number of migrants risking their lives in the Mediterranean. The presentation is divided in theses which aim to elicit a debate on issues such as rights to mobility, human rights and globalization.

# Forced migration and climate change: a new refugee category?

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**Keywords:** climate change; migration; international law

## ABSTRACT

Until 2050, 143 million people may have to flee their homes due to climate change, mostly the ones located in coastal zones and vulnerable areas. The change in weather patterns, the rising sea levels, the exponential increase of natural disasters and severe droughts are not only examples of the climate change impacts but are also drivers for forced migration. Empirical evidence suggests that most of the migration will occur within the countries, rather than in international borders and that it may occur in developed and developing countries and its real consequences depend strongly on the country's capacity to be resilient and adaptive<sup>[1]</sup>. However, when dealing with displacement in developing countries, people may also move due to a combination of factors, such as existing poverty and vulnerability, political instability or economic crisis, where climate is best conceived as a threat multiplier which exacerbates existing problems. It is possible to state though that the climate may provide a tipping point that would not be otherwise achieved only with the other factors<sup>[2]</sup>. Even so, until today, there is no international regime to protect people that migrate due to environmental or climate reasons, since this concept does not fit into the 1951 Refugee Convention. Alongside with the international legal gap, parallel long-term actions emerge as a strategy to prevent (in the source) the displacement of people, such as projects in the area of environmental risk reduction, adaptation and resilience measures, disaster risk policies, among others. Nevertheless, an immediate legal response to address people displaced due to climate drivers is necessary, since the prospects of forced migration are real<sup>[3]</sup>. At this point, in the time being, courts and decision makers may use human rights as a legal framework to protect displaced people, in order to cope with the present climate crisis.

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# **Determinants of Migration and Influential Actors and Factors behind the Destination Choice: Afghan and Syrian Refugees in Stuttgart**

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**Keywords:** Afghan and Syrian refugees, destination choice, migration determinants

## **ABSTRACT**

The highest number of people recorded on the move across the world makes it increasingly important for researchers and policy makers to not only know the central causes of migration but also the reasons and motivations behind the migration of people from and to specific countries.

We analyse the major determinants of asylum-related migration and identify the actors and factors influencing refugees' decisions to migrate to Germany. Theoretical sampling is used for this study which is based on individual in-depth interviews and focus group discussions (FGDs) with a total of 87 Afghan and Syrian refugees including men, women, families and unaccompanied minors who have migrated to Germany between 2011 and 2018. The respondents reside in either refugee camps or residential houses in Stuttgart.

Our findings show that in addition to violent conflict, war and political insecurity in the countries of origin or transit, compulsory military services for young Syrians, ethnic and religious discrimination, lack of valid documents for residency, economic challenges, and limited perspective for their children have been the major reasons for both nationalities that compelled them to migrate. It is a common pattern that refugees first migrate to a neighbouring country and the bad political and socio-economic conditions there induce them to migrate further.

Among the respondents, 95% of Syrians and 25% of Afghans have selected Germany as preferred destination at the time of departure. The main factors for those chosen Germany are the chance for higher recognition rate specifically for Syrians, expected education and favourable economic conditions for both. Majority of Afghan respondents (75%) have planned to migrate to Europe without planning for a specific country at the time of departure. People smugglers, other asylum seekers in transit countries, social bonds and social media have played the most influential role in the determination of their destination countries.

# Global Compact of Migration: an important tool of guaranteeing migrants rights and promoting sustainable development

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**Keywords:** Migration; Global compact for Migration, Cooperation, Solidarity, Sustainable Development.

## ABSTRACT

Migration flows have greatly increased since the turn of the century. The wars in Afghanistan and Iraq, the 2008 economic crisis, the Arab Spring, and the rise of right-wing governments are some of the reasons of this “distress”. In this sense, in December 2018, the United Nations General Assembly aiming at making these flows safe, ordered and regular approved the Global Compact for Migration [1]. In other words, it essentially prescribes the need for governments to come together and cooperate with each other so that migrants are not seen as a threat by local population, and as a burden by governments – growing discourses/arguments in regions more affected by flows. More than that, through these soft obligations set by the Global Compact, sustainable development may also be achieved in these regions, since migrants would not be seen as a menace or an inconvenience, but as contributors to achieving sustainable goals. Therefore, this proposal aims at demonstrating, first, the fallacious discourses of regarding migrants, and how there seems to be a lack of solidarity in the modern society to help others in times of necessity [2], sometimes, even created by them; and, second, the origins and the objectives of the Global Compact for Migration, specially regarding its “demands” for more cooperation and its deep relation to the United Nations Sustainable Development Goals (ODGs) [3]. As a partial conclusion, one may note that, because of its roots in the ODGs, the Global Compact for Migration demonstrates not only why cooperation is essential to promote dignity and other basic rights among migrants, but also how these very people may help the countries of destination to fulfill other soft obligations they have under international law, precisely those regarding the achievement of local and regional sustainable development.

[1] UN. (2018). Global Compact for Migration. Retrieved on Jun 15 2019 from <https://www.iom.int/global-compact-migration>

[2] Bauman, Z. (2007). *Tempos Líquidos*. São Paulo: Zahar.

[3] UN. (2015). The 2030 Agenda for Sustainable Development. Retrieved on Jun 15 2019 from <https://sustainabledevelopment.un.org/?menu=1300>

# **Brazilian reception of Venezuelan Refugees: a *de facto* implementation of the Global Compact for Migration?**

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**Keywords:** Venezuelan Migrants, Operação Acolhida, Sustainable migration, Global Compact for Migration.

## **ABSTRACT**

Brazil has been considered a country of destination of many Venezuelan migrants since 2015. And since the numbers have spiked at the end 2017, the Brazilian government edited a series of Decrees implementing a military operation called '*Operação Acolhida*' in order to help those who arrive at the northern frontier. This operation is based in three pillars: (a) welcoming and identification, (b) sheltering, and (c) interiorization. The first one intends to welcome those who arrive with meals and vaccines, and also regularize their situation within Brazil and give them Brazilian identification cards. The second one is directed to provide them with a provisory shelter, where they can have the minimum standards of hygiene, and nutrition, until is needed. And, finally, the third one is directed to move those who want to other parts of Brazil, either because of a job offer or because they have family members or friends already there. This Operation, very much criticized in the beginning because of the use of military personnel, however, can be set as an example of how a country may sustainably deal with migratory flows, safeguarding migrants basic rights and orderly/safely integrating them with the local environment. In this sense, this proposal aims, first, at presenting the operation itself to see if it really relates to the United Nations Sustainable Development Goals (ODGs) [1], as it is said it is. Not only that, secondly, the outcomes of the first year of the Operation are to be stressed, especially considering it was renewed for a second term because of its success. Besides, thirdly and finally, this proposal intends to demonstrate that Brazil is, in practice, implementing the Global Compact for Migration [2] even though it pulled out from such declaration in the beginning of 2019.

[1] UN. (2015). The 2030 Agenda for Sustainable Development. Retrieved on Jun 15 2019 from <https://sustainabledevelopment.un.org/?menu=1300>

[2] UN. (2018). Global Compact for Migration. Retrieved on Jun 15 2019 from <https://www.iom.int/global-compact-migration>



# Are refugees a threat? The demystification of the impact caused by immigrants within countries' of destination

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**Keywords:** Refugees; hate-speech; states' failure; Global compact for Refugees.

## ABSTRACT

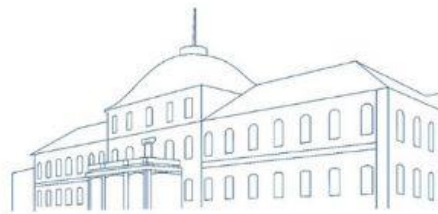
Migrants can be divided into two groups: those who only receive the protection prescribed by states, and those who receive the protection of international treaties, beyond national statutes and regulations. This second group can also be divided, but into three parts: stateless people, asylum seekers and refugees. This third subdivision is one of great importance now-a-days, especially considering the current and rising flows based on persecution suffered due to race, religion, nationality, being part of a particular social group/minority, and political opinion. Nevertheless, instead of protecting the refugees who arrive in a certain country, guaranteeing their rights, including them in local communities, and fulfilling all international law obligations on this matter, what it seems to occur is that countries of destination are becoming more closed, feeling threatened by "those who knock on their doors" [1], because they have a different (cultural) identity [2]. This outcome, however, tends to create a deviation of communication due to individualized practices, induced by nationalists/right-wing governments, who put the blame on the refugees for states' economic/social/environmental failure. Therefore, this proposal aims at demonstrating, first, the status of the current world refugee crisis and trace the discriminatory patterns created by some nations towards them; and, second, how refugees can actually sustainably collaborate in the country of destination [3], ruling out any possible relation to a state's failure. As a conclusion, it is possible to say that hate-speech towards refugees is a fact, and that some nations/people do not see how much the diversity brought by them could be beneficial, being this the reason why the Global Compact for Refugees [4], approved in December 2018 by the United Nations, should be better publicized and taken into account by countries worldwide, as it prescribes newer/updated outlines for nations to absorb refugees in their society.

[1] Bauman, Z. (2017). *Estranhos à nossa porta*. São Paulo: Zahar.

[2] Bauman, Z; Mauro, E. (2016). *Babel: entre a incerteza e a esperança*. São Paulo: Zahar.

[3] UN. (2015). The 2030 Agenda for Sustainable Development. Retrieved on Jun 15 2019 from <https://sustainabledevelopment.un.org/?menu=1300>

[4] UN. (2018). Global Compact for Refugees. Retrieved on Jun 15 2019 from <https://www.un.com/unhcr/global-compact-refugees>



Abstracts

**Session A4**

**Renewable energy**

# The Circular Economy Under the Biomass Cascade Approach

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**Keywords:** natural resources, biomass cascade

## ABSTRACT

The natural resources in a developing country suffer higher impact than anywhere in the most developed ones, bringing pressure to make more with less. Under this concept the biomass cascade approach is important to change the reality of a low tech country, even a worldwide supplier of agricultural commodities, that is the case of Brazil, to a high technology producing country. Even in a country with a lot of natural resources, such is Brazil, a better and full use of biomass is crucial. Brazil is basing its bioenergy program most in sugar cane ethanol (first and second generation), which is very risky in terms of possible threats and competition from other biomass sources. Therefore, a better use of its large amount of biomass waste is a priority, since will maximize the current yield of energy crops. Can be listed here primary sludge and black liquor from pulp and paper industries, eucalyptus bark, sugar cane trash and also an almost endless source of raw materials: the MSW (Municipal Solid Waste). Brazil needs to have a better use of its biomass, instead just a direct burning for energy conversion. Processes like pyrolysis and gasification and under recent developments in several places in Brazil and are discussed in details. The innovation in Brazil is very low, at levels compared to least developed countries and a better use of its biomass can helps to bring sustainability to the agribusiness sector and transfer technology to other industries. In this processes some case of success are discussed, such and the automotive and aeronautical sectors. The production of biobased materials and chemical feedstocks can reduce the pressure over more agricultural land (including Amazon rain forest), water resources and social inequities.

# The resource nexus and biofuels: a comparison of Brazil and German case studies

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**Keywords:** Resource nexus, Reflexivity, Governance, Biofuels, Bioenergy.

## ABSTRACT

Promoted as an important renewable source worldwide, bioenergy entails a large spectrum of externalities and feedback effects, involving important natural resources, such as water, land, and biodiversity. Making sense of the complex interactions and measuring all these impacts translates into significant challenges for developing and implementing bioenergy policies, especially when there are divergent interests and social values. This paper departs from a resource nexus perspective [1] to explore governance challenges, by adopting biofuels policies in Brazil and Germany (and in the European Union, more broadly) as case studies. On a theoretical level, the paper argues that nexus research could benefit from insights from reflexive governance literature and vice-versa. The study employs a conceptual framework that sheds light on the importance of deliberation to promote more responsive governance structures. Specifically, deliberation can bring about positive results by handling tensions in four dimensions, namely: sources of knowledge; composition of public discourse; institutional architecture; and institutional dynamics [2]. Empirically, the case studies illustrate how nexus issues play out differently across regions, even considering the same policy domain. In the European Union, land use was much more relevant in the food vs. fuel debate following the food prices crisis in 2008. In Brazil, only recently water became an issue for consideration in biofuels policies and is still limited to academic discussions [3, 4]. The paper concludes that if bioenergy policies are to take the mitigation goal seriously, environmental safeguards cannot be treated as an add-on, alerting for the dismantling of environmental governance underway in Bolsonaro's administration. It also suggests that cognitive and normative aspects that influenced broader deliberation on biofuels will remain relevant for the deployment of bioenergy as part of a negative emissions strategy in the future. The conclusion highlights the need to consider such aspects in nexus research and to expand the debate about the role of bioenergy beyond transformations in the energy sector.

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# Achieving multiple Sustainable Development Goals in rural communities through participatory energy projects based on renewables

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**Keywords:** Social Value of Energy; Energy-Poverty Nexus; Participatory Energy Projects

## ABSTRACT

Achieving the Sustainable Development Goal (SDG) number 7 (affordable and clean energy for everyone) is essential for achieving multiple SDGs [1]. For that, renewable energies play an essential role, especially in rural areas of developing countries with no or limited access to the grid. While renewables are important for sustainable development, if energy projects are inappropriately designed, the provision of energy can miss opportunities or bring risks and burdens to local people. For example, without adequate institutional and administrative controls, energy can increase opportunities for child labor, leading children to drop out of school.

The "Multi-layer Framework for Social Value Creation" [2] can contribute to create greater social and economic value to communities and advance on multiple SDGs, while avoiding or minimizing side effects of energy. The framework understands the Social Value of Energy as the sum of all economic and non-economic benefits minus the cost of energy and additional risks and burdens for local communities. The framework differs from business-as-usual practices by considering the environment (e.g. political and social) in which communities exist and engaging with community members in a participatory way during the phases of designing, implementation and management of energy projects.

Through a one-year project (2018-19) of applied research [3], supported by the Global Consortium for Sustainability Outcomes [4], research teams from the Arizona State University (ASU) and the Karlsruhe Institute of Technology (KIT), jointly with partner organizations from Bolivia, Uganda, Nepal and Philippines (one non-governmental organization and three enterprises) applied the "Multi-layer Framework for Social Value Creation" to local energy projects.

Preliminary results indicate that the application of the framework can deliver improved projects that go beyond the SDG7 and enable communities to take more advantage of energy to achieve additional SDGs. The framework can empower communities to use energy more effectively to create additional social and economic value and reduce costs and burdens for beneficiaries. Finally, the ASU and KIT research team intends to replicate the above-mentioned project in Brazil and other countries while creating national hubs of local partners that visualize, design and implement participatory energy projects focusing on the increment of community sustainability.

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# Strategic Environmental Assessment (SEA) for renewable energies: Brazil and Germany compared

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**Keywords:** Strategic Environmental Assessment, climate protection, renewable energies, social and environmental impacts

## ABSTRACT

Regarding concerns about the effects of climate changes, both Brazil and Germany have assumed commitments in international fora, notably the Paris Agreement, to reduce greenhouse gas emissions, and renewable energies are a core sector for its mitigation. However, adverse social and environmental impacts go hand in hand with their mitigation potential, and should necessarily be considered in the design, implementation and governance of the rolling out of the technologies and projects within both countries.

The Strategic Environmental Assessment (SEA) first emerged as a central tool in sustainable development and was preceded by the Environmental Impact Assessment (EIA). Today, SEA should be a precursor to the EIA: it is both broader in scope in that it extends to social impacts, and also deeper in reach in that it lays down a forward planning framework in the early stages of public policies, plans and programmes, standards and legislation.

This paper explores this instrument in terms of its application to renewable energies both in Brazil and Germany in the context of climate change, taking account of the concept and importance of environmental evaluation for the climate mitigation potential of renewable energies. The SEA instrument is defined, and comparison is drawn on the approaches to its implementation in Brazil and Germany.

The first thing that can be noticed is that Brazil does not have any legislation on the subject, so its study in the country was based on the literature. In the opposite, Germany follows the EU legislation, with both a Protocol and a Directive and many reports on its implementation and evaluation. The similarities found are that both countries present same goals and principles for the instrument and recognize that it needs improvement and that the procedures might vary. An important difference is that the Brazilian literature has a large concern on social effects.

Regarding the energy sector, Brazil's use of environmental evaluation and strategic and integrated assessments are mostly related to huge and controversial hydropower plants, mainly in the Amazon region. In Germany, it is mostly used to offshore wind turbines, as well as a recent and not yet concluded SEA on transmission lines.

# Smart Services Assessment for Energy Communities

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**Keywords:** Smart Service, Energy Market, Energy Communities

## ABSTRACT

Recent regulations in the German energy industry supported the emersion of projects related to the demand management [1] and new ideas, such as Smart Energy Communities (SECs), found their way into the existing regulatory system [2] [3]. SECs consist of a group of households with different electric loads and technologies integrated into a control system, which manages generation and demand in the community [3].

Different technologies support the provision of smart services in order to help SECs manage their supply and demand [4] [5]. Information Systems (IS) support the energy market regarding data acquisition infrastructure, algorithms, data reports and user interfaces for visualization and configuration [1]. Hence, IS-based smart services could improve the control system from SECs, optimizing production and predicting demands. However, the investment limitations from these local networks hinder their resources to acquire technologies [6] and a prioritization of these services, based on their potentials and drawbacks, becomes relevant.

Risk assessment methodologies can support the prioritization of smart services. This study used the Multicriteria Mapping Method (MCM), which follows rigorous steps to design the analysis' process and provide relevant insights on technology assessment [7]. We used insights from stakeholders, who assessed eight smart services according to their potential for the communities. During the assessment, they considered different criteria, such as final consumer; external factors; relevance; economic and ecological perspectives.

Results show a positive view from stakeholders regarding the use of measured data for applications, as well as smart services that support investment opportunities and optimization of production and consumption, as they foresee a positive scenario for data analysis and insights on consumption. On the contrary, they seemed more skeptical about consumers selecting a different energy mix and peer-to-peer trading. Since communities already exist and there is a lack of genuine marketplaces, peer-to-peer trading might be difficult to establish. They also mentioned the price-sensitivity of consumers, who might find the option to have an energy proof-of-origin not very relevant.

This work contributes to the development of future smart services and digital ecosystems platforms in the energy industry by providing insights on the relevance of smart services for energy communities.

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## **Production and characterization of biochar from macauba endocarp (*Acrocomia aculeata*)**

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**Keywords:** A.aculeata, macauba, endocarp, biochar

### **ABSTRACT**

Macauba (*Acrocomia aculeata* (Jacq.) Lodd. ex Mart.), a palm tree abundant in the Brazilian savannah (cerrado), has been prominent in the production of vegetable oil. Its fruits are rich in oil both in its pulp (mostly unsaturated) as in his almond (mostly saturated) which significant pharmacological potential[1] and promising energy crop due to the high bioenergy production potential[2].

Some solid wastes are generated after extraction process of these oils. Among them, the almond and pulp bran, used in animal feed, and the endocarp (shell).

The endocarp involves the almond and, through thermochemical conversion, can be transformed into carbonaceous material and be applied as soil conditioner, adsorbent material in water and wastewater treatment, among other applications. In this study, the in natura endocarp was heat treated in an oxidant atmosphere, at temperatures of 200 °C (B-200), 300 °C (B-300) and 400 °C (B-400) by 2 h.

The different charcoals (biochars) were thoroughly analyzed by different analytical techniques, including Thermogravimetry analysis (TG/DTG), Scanning Electron Microscopy (SEM), Textural Analysis (surface area BET and pore volume), X-ray Diffractometry (DRX) and Infrared Spectroscopy (FTIR).

These analyses evidenced that the carbonization temperature of has a significant influence on the characteristics of the materials obtained, as in the textural characteristics of the products obtained. The BET analysis showed an increase of area *ca.* 10 times for the material heat treated at 400 °C (B-400) in relation to material obtained at 300 °C (B-300).

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# Fast pyrolysis of sugarcane biomass and hydrotreatment of pyrolysis oil for production of renewable fuels and chemicals

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**Keywords:** sugarcane bagasse, thermochemical conversion, hydrodeoxygenation

## ABSTRACT

Sugarcane is one of the main crops for production of ethanol and sugar worldwide. Around 1.6 billion tons are annually produced, resulting in 448 million tons of sugarcane bagasse as by-product. Brazil alone generates 178 million tons of bagasse due to the 635.51 million tons of sugarcane produced per year [1].

The integration of a 2nd generation thermochemical conversion unit in the sugarcane biorefinery for bagasse valorization shows many advantages: Differently from other types of biomass, collection and transportation are not required; decentralized conversion and transportation of pyrolysis oil usually proposed for other crops is also not necessary, due to the fact that sugarcane bagasse is already centralized in the refinery [2], [3]. Additionally, the high lignin content, considered a limitation for other conversion routes, makes fast pyrolysis an interesting conversion technology, due to the high number of functionalized aromatic products and hydrocarbons which can be obtained [4].

Considering the limited data regarding the valorization of sugarcane bagasse by fast pyrolysis, followed by catalytic upgrading, the present work combines sugarcane bagasse characterization, thermochemical conversion, and catalytic hydrotreatment of the pyrolysis oil comparing two nickel-based catalysts, both successfully tested for other types of pyrolysis-oil in our previous studies.

High yields of pyrolysis oil could be obtained (48.7 % dry basis) by fast pyrolysis, mainly attributed to the low moisture, potassium and sulfur contents, despite the high ash concentration in the sugarcane bagasse.

Oils with improved properties, i.e. low water and oxygen content, could be obtained after hydrotreatment. Reactions conducted with Ni/SiO<sub>2</sub>, resulted in upgraded oil with 8.3% water and 20.74% of oxygen. The higher heating value increased 63% in comparison to bagasse. Distinct selectivities were observed for both catalysts.

Higher hydrogenation and higher conversion of organic acids was obtained with Ni Cr/SiO<sub>2</sub>, whereas higher conversion of aromatics was observed with Ni/SiO<sub>2</sub>.

In summary, sugarcane bagasse is a suitable feedstock for pyrolysis followed by hydrotreatment. An overall yield of 30.5 wt.% of upgraded products in regard to the biomass feedstock was obtained. Due to the molecular weight and higher viscosity compared to pyrolysis-oil, further studies should consider to reduce polymerization of upgraded products.

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# Synthesis of new esters from moringa oil (*Moringa oleifera*) with lubricant potential

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**Keywords:** Moringa oleifera, Biolubricants, Thermalstability

## ABSTRACT

Concern about the environment has been growing and has become a public issue over the last few years. The potential depletion of oil reserves, climate change, and environmental problems have attracted research interest on areas focused on developing alternative eco-friendly products that present less environmental impact and have a better or similar performance than petroleum products. In this sense, the development of biolubricants based on vegetable oils has stood out. *Moringa oleifera* is a fast-growing and drought tolerant tree. Moringa seed contains between 28% and 42% oil by weight and it is considered a promising candidate for future uses as a biofuel. Thus, the aim of this work was to synthesize new esters with lubricating properties using polyols, trimethylolpropane (TMPE\_M) and pentaerythritol (PEE\_M) from the moringa oil (MO). The seeds were placed in a Soxhlet system to obtain moringa oil with an average yield of 35% w/w. As a route of production of the biolubricants, saponification reactions were initially performed with MO, followed by neutralization for the production of free fatty acids (FFA). The obtained FFA were subjected to esterification reaction with the polyols and p-TSA as catalyst [1]. It was possible to determine the structure of the esters of *M. oleifera* by FTIR and <sup>1</sup>H and <sup>13</sup>C NMR. The thermogravimetric behavior under synthetic air flow was evaluated and the biolubricants presented three thermal events similar to the triglycerides. The degradation onset temperatures of the first thermal event, at a rate of 10 °C.min<sup>-1</sup>, were 257.2 °C (PEE\_M), 278.0 °C (TMPE\_M). DSC analysis made in inert atmosphere showed a degradation onset temperature of 416.5 °C (PEE\_M) and 418.8 °C (TMPE\_M). The esters showed an LC<sub>50</sub> against *Artemia salina* higher than 1000 µg mL<sup>-1</sup>. Therefore, they can be considered non-toxic against *A. salina*. The thermal stability of the esters was considered satisfactory, with high DTG and DSC onset temperatures. In addition, no toxicity against *A. Salina* was found, which indicates promising substances to be used as an ecological lubricant.

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# Synthesis of CO<sub>2</sub> – neutral fuels and allyl alcohol from vegetable oil

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**Keywords:** FAME's, allyl alcohol, photoinduced decarboxylation

## ABSTRACT

The man-made climate change nowadays forces us into the research of new energy forms based on renewable sources or CO<sub>2</sub> – neutral fuels. For this reason we investigated in this work the biodiesel synthesis (fatty acid methyl esters, FAME's) and especially the overcoming of the production of millions of tons of glycerol as a side-product by its conversion into a more valuable chemical.

Therefore we used vegetable oil, methanol and camphorsulfonic acid for the transesterification to FAME's.<sup>[1]</sup> In the second step we treated glycerol with trimethyl orthoformate and pyridinium para-toluenesulfonate to get the orthoester of glycerol.

In this process we synthesized FAME's as CO<sub>2</sub> – neutral fuels out of the vegetable oil in acidic conditions. In our work we could recycle most of the catalyst. Next, we could transfer glycerol into an orthoester in very mild conditions. This substance could be converted finally into allyl alcohol.

In another approach we analyzed the photoinduced decarboxylation of fatty acids to hydrocarbons, based on the work of Nicewicz et al.<sup>[2]</sup> We treated several fatty acids with different photoredox catalysts and different hydrogen-supporters.

Hereby we could find the new, more stable and much cheaper photocatalyst riboflavin.

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# **Groundwater supply: impacts on the Brazilian electricity system and assessment of scenarios for sustainable development**

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**Keywords:** Groundwater, Pumping, Power Sector, Supply, Energy efficiency

## **ABSTRACT**

The study aims to investigate the impacts of groundwater supply in the Brazilian energy sector, the dynamics of decision making in water management and Brazilian energy management, and to point out where actions for sustainability in pumping groundwater must be taken. Power generation, consumption and management interact in many ways with water resources, yet surface water management differs from groundwater management. About 2.6% of Brazilian energy consumption is used for groundwater supply. Actions for energy efficiency in this sector can bring energy savings.

## PVC plasticizer from renewable sources

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**Keywords:** Plasticizers, PVC, renewable sources

### ABSTRACT

The PVC is very versatile due to its easy interaction with additives. Important examples are the plasticizers, which provide flexible properties to the PVC. [1] Since 1920, phthalic acid esters have been used as plasticizers, but studies have shown that these compounds are toxic and their use is restricted in several countries. Besides, they are derived from petrochemical sources. Thus, the development of a non-toxic, non-greasy plasticizer is essential. [2] Therefore, the present study presents the preparation of a plasticizer for PVC from renewable source, the oleic acid, more precisely, the trioleato of trimethylolpropano. This oil was subjected to an epoxidation reaction, to introduce polar groups into the molecule, improving its interaction with PVC. The synthesized plasticizer (EPO) was characterized by GPC, <sup>1</sup>H NMR, IR, TGA and DSC. Subsequently, dry blend materials were prepared using a standard formulation: 50 PCR of plasticizer in relation to PVC resin, as well as thermal stabilizer, external lubricant and optical brightener in the proportions of 3, 0.5 and 0.02 PCR, respectively. Then, they were passed on a calender with rolls at a temperature of 130 ° C, cut into squares, stacked, pressed and cut into tie-shape samples. These specimens were submitted to TGA, DSC, DMA, Tension-deformation, Hardness Shore A and Rheology analysis. For comparison purposes, dioctylcyclohexanoate (DOCH), a commercial plasticizer from petrochemical source, was used. The following formulations of plasticizers were employed: DOCH 50; 40 DOCH/10EPO, 25DOCH/25EPO e 10DOCH/40EPO e 50 EPO. The results showed that the addition of the epoxidized vegetable oil (EPO) increases the thermal stability of the material by up to 40 ° C and the elongation at break, reaching a maximal in the proportion of 25DOCH/25EPO, however a raise occurs in the elastic modulus indicating greater material resistance to deformation, which was also verified in the hardness test. The Shore A hardness of the EPO 50PCR resin was 89, while the DOCH 50PCR was 82. These results demonstrated that EPO, a renewable source plasticizer, is a potential substitute for DOCH, increasing the elongation at break and thermal stability and, decreasing the glass transition temperature relative to resin.

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# Energy efficiency automation systems in the headquarter of the Technology without Borders Association in Brazil

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**Keywords:** energy efficiency, automation systems, sustainability

## ABSTRACT

The use of electronic components to automate processes becomes increasingly common. Automation can bring solutions to the automotive, educational, industrial and electricity sectors, among others. Building automation has potential energy saving benefits. Thus, this study aims to examine and analyze the effect of automation applications in the Technology without Borders Association (TeoG) headquarter in Brazil. Therefore, a higher energy performance of the building project is expected. Hardware and software like Arduin and EnergyPlus are going to be employed in order to simulate the constructive solutions to enhance thermal comfort. Green roof, exterior color, wood shutters, door and window positions are among the building features to be considered. Automatic watering systems and humidity control of the green roof are some of the tests to be carried out. The data collected will be compared and analyzed. Consequently, the results will affect the decision making process referring to the implementation of constructive strategies. It is expected that the investigation can contribute to the advancement of theories and practices in the area of smart and sustainable building approaches particularly in subtropical areas.

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# Techno-economic and environmental assessment of the electric energy generation potential of biogas produced at Santa Luzia Wastewater Treatment Plant (Criciúma/Brazil)

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**Keywords:** Wastewater Treatment Plant, Biogas, Electricity, CO<sub>2</sub> emissions

## ABSTRACT

Waste valorization for energy purposes has been of major economic and environmental interest nowadays [1]. This study aimed at the techno-economic and environmental assessment of potential electric energy generation from biogas produced at Santa Luzia Wastewater Treatment Plant (WWTP), in Criciúma, South of Brazil. Data of physical-chemical parameters of affluent/effluent and electricity consumption during 2016/2017 of the WWTP was obtained and used to estimate the potential electric energy generation from biogas as well as the avoided carbon dioxide (CO<sub>2</sub>) emissions to the atmosphere. Finally, calculations were made to estimate the capital expenditures and economic indicators such as payback. The results demonstrate that the anaerobic digestion process in the WWTP reactors develop at pHs close to neutrality (affluent =  $6.68 \pm 0.26$ , effluent =  $7.05 \pm 0.11$ ) and at mesophilic temperatures ( $24.2 \pm 2.4$  ° C). The Chemical Oxygen Demand (COD) removal efficiency of the reactors was 49%. The estimated production of methane (CH<sub>4</sub>) and biogas was higher in the months of March (19%), July (16%) and September (14%). The estimated total electricity generation was 788,975 kWh/year, which is capable of supplying 95% the energy consumption of the WWTP. The use of biogas can reduce 93.5% of the total CO<sub>2</sub> emissions. The payback was estimated in 21 months. In conclusion, the use of biogas for generating electricity at Santa Luzia Wastewater Treatment Plant is promising, being able to reduce its operating costs and mitigate environmental impacts caused by sanitary sewage, contributing to the usage of renewable energy sources.

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## Fuel properties of young bamboo and eucalypt plantations

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**Keywords:** energy, biomass, fast growing species

### ABSTRACT

Forests are one of the most reliable and antique source of energy for humans and about 2.4 billion people use it as a woodfuel [1]. Eucalyptus is an important genera for forest products industries, in Brazil it represents 72,7 % of Brazilian planted forest areas [2]. Bamboo is one of the largest native reserve of biomass in tropical countries and it could contribute to the energy needs of the future: clean, renewable, sustainable and modern. This work had as objective to perform the proximate analysis – fixed carbon, ash and volatile matter – and HHV (higher heating value) in a short rotation coppice of *Eucalyptus urophylla* (clone AEC 0144) and *Bambusa vulgaris* with 1 and 2 years after planting. To accomplish this task, the tree was fractionated into leaves, branches and stem (0 %, 25 %, 50 %, 75 % and 100 % of the plant height). Bamboo presented a direct relationship to ash accumulation on the stem while the eucalypt indicated an inverse relationship from the first to the second year. HHV from the bamboo stem (17,5 MJ kg<sup>-1</sup>) was higher than other biomass fractions. Bamboo had a low content of volatile matter (78 %) and a high fixed carbon content (17 %), but showed a double ash content than eucalypt. Hence, *Bambusa vulgaris* has characteristics that allow its use as a hog or woodfuel as the *Eucalyptus* species.

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# Characterization of agro-residues for bioenergy production in Costa Rica.

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**Keywords:** biomass, bioenergy, pellets

## ABSTRACT

Lignocellulosic material has been considered as a potent raw material for the production of biofuels, either as a gaseous, liquid and/or solid fuel to meet energy demands. For the overall efficiency of processes designed to convert lignocellulosic materials into the desired biofuel, it is important to understand the characteristics of these lignocellulosic components. The present study points to the physicochemical characterization of two agricultural residues of greater importance in Costa Rica. Due to this, two of the main residues have been studied: coffee pulp and pineapple stubble for energy purposes. For this purpose, pellets were obtained from them and from a mixture made up in a 50:50 mass ratio of each residue. The study was performed under different values of moisture and particle size for each pellet processing. Unit density and apparent density were determined with values between 1.09 kg/dm<sup>3</sup> to 1.32 kg/dm<sup>3</sup>, 555.30 kg/m<sup>3</sup> to 578.23 kg/m<sup>3</sup> respectively. In the case of friability and durability, results were found with values ranging from 0.89 to 0.99 and 92.29% to 98.33% respectively, values that meet the requirements of the standard. It was determined that the physical properties improved for higher moisture values and lower particle size. In addition, the material used was characterized by finding high contents of sulfur, chlorine and nitrogen in the pineapple stubble that are above that recommended in the standard. The coffee pulp fulfilled all the established in the standard and presented values of lignin superior to the pineapple stubble benefiting the process of pelletizing. The results indicate that coffee pulp and pineapple stubble and its mixture suggest that a high quality biofuel could be produced for use in a thermochemical conversion process such as combustion, gasification and pyrolysis.

## **Growth, productivity and gas exchange of *Bambusa vulgaris* Schrad. ex J.C. Wendl. on short rotation planting**

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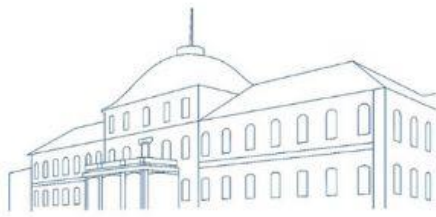
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**Keywords:** bamboo, vegetative development, biomass, photosynthesis, chlorophyll

### **ABSTRACT**

Bamboo (*Bambusa vulgaris*), although presenting dendroenergetic characteristics similar or superior to eucalyptus [1,2], still presents limited cultivation in Brazil, justified by the lack of technical information about the culture, thus obtaining knowledge about the adaptation and phenology of the species, with the purpose of improving technological management of the planting. In this context, the present work had as objective to evaluate gas exchanges and parameters of vegetative development and productivity of bamboo in the planting of short rotation for power generation. The bamboo was planted in January 2016, with a spacing of 3 m x 2 m. The evaluated parameters were: stem diameter and height, biomass production, gas exchange, and SPAD index. The evaluations were carried out between September 2016 and August 2017. For the measurement of gas exchange and SPAD index 15 plants per plot, were randomly selected and measured monthly with the infrared gas analyzer IRGA (LI-COR 6400) and chlorophyll meter (SPAD-502), respectively. In order to calculate the trunk biomass, the commercial volume was multiplied by the basic density of the bamboo. Bamboo cultivation showed a high photosynthetic yield ( $15.86 \text{ } \mu\text{mol CO}_2 \text{ m}^{-2}\text{s}^{-1}$ ), higher values of SPAD index (43.31) and high efficiency in water use ( $\text{EWU } 3.41 \text{ } \mu\text{mol CO}_2 \text{ mol H}_2\text{O}^{-1}$ ), as well as higher growth (2.88 cm of stem diameter, 3.2 m of total height) and biomass production ( $8.07 \text{ kg pl}^{-1}$ ) when compared to other bamboo species [3,4,5,6,7]. The results show that the higher contents of chlorophyll promoted greater assimilation of carbon-producing greater increases of biomass, making the use of water more efficient.

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Abstracts

**Session B4**

**Combining biophysical and  
socio-economic models**

# Combining agent-based models and crop growth models to simulate farmers decision-making and policy interventions

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**Keywords:** Agent-based simulation, diffusion of climate-friendly technologies, high-performance computing

## ABSTRACT

Agent-based modeling (ABM) is a powerful technique to simulate individual farms and their spatial and environmental interactions. By combining ABMs with biophysical models, one can implement a holistic modeling approach that allows both economic and environmental goals to be taken into account. Such an integrated approach have been suggested as an essential tool for assessing the impact of policy intervention since the impact of policy actions depends on site-specific characteristics of the farm and its region. With three study cases, we show how integrated assessment approaches have been used to evaluate alternative options to improve farming systems and to promote the adoption of low-carbon agricultural systems in Brazil. The first study evaluates the effectiveness of credit lines with subsidized interest rates in promoting the adoption of integrated agricultural production systems [1]; the second estimates the adoption of a novel production system, the cultivation of sunflower [2], while the third evaluates the determinants for reduction of yield gaps—the difference between the potential and actual yields [3]. The model simulations seem to generate highly realistic results, achieving good validation indices and capturing different responses from a broad range of macro-regions, macroeconomic conditions, and biophysical constraints.

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# **Economic and ecological assessment of crop rotations and management strategies using simulation models**

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**Keywords:** Agriculture, agro-ecosystems

## **ABSTRACT**

Agriculture is the main interface between man and nature, with man intensively exploiting natural resources for food production. Agriculture requires land, but also water and nutrients, and thereby causes conflicts with other land uses, which aggravate under increasing pressure of climate change and a growing number of people on the planet. Land use decisions are often made under purely economic considerations, in extreme cases driven by sheer hunger or fear of losing livelihood. Sometimes, however, land use decisions are made in the absence of information on possible trade-offs and could potentially have resulted in alternative decisions. Simulation models can highlight some of the trade-offs that land use decisions, but also other management decisions evoke. Simulation models for biophysical processes in agro-ecosystems and simulation models for farm economic processes are developed in with different disciplinary background. Even though they share agricultural yields as one common variable, they often exhibit different modelling concepts that are difficult to bring together. There is a number of examples that show attempts of coupling agro-ecosystem and farm models to monetise agricultural decision in crop production in the context of environmental pollution and resource consumption. This keynote will show some of these examples and present the latest attempts in this direction that address also larger scales.

# Productivity slowdown or paradigm shift? Schumpeter meets Georgescu-Roegen

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**Keywords:** Transformation, Bioeconomy, Economic Development

## ABSTRACT

In the paper we analyze economic growth and its major trends for the last 50 years and contrast recent observations with the so-called *innovation slowdown* postulated by R, Gordon [1]. Triggered by the first wave of digitalization (Appollo-Effect) income development skyrocketed. Although first warning voices emphasized the impact of manmade economic organization on environment (Club of Rome Effect) again 50 years ago, the emerging environmental industry did not contribute to an improvement of the overall situation and at the beginning of the 21st century, it becomes obvious that due to rebound effects, mankind is confronted with severe threatening challenges. To avoid large catastrophes, a fundamental transformation of the economic system is required, which combines the exploration of new technological trajectories with qualitative change instead of quantitative growth alone. As emphasized by Schumpeter [2] innovations will play a decisive role but need to be accompanied by normative considerations as explicated by Georgescu Roegen [3]. In the paper we show how this necessary development might be mastered with innovation systems dedicated to a transformation towards a knowledge based digital bioeconomy.

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# Combining socio-economic and remote sensing data for food insecurity prediction using neural networks

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**Keywords:** food insecurity, socio-economic data, remote sensing data, convolutional neural network, recurrent neural network

## ABSTRACT

Aid organizations and governments are applying great effort in resolving the negative impacts of food insecurity induced crisis like famines or mass migration. One of the most limiting resources these actors face is the lack of preparation time for consistent and sustainable planning for emergency relief like setting refugee camps or securing supply with food and energy. Hence, increasing the lead time for preparation is an essential step and will result in saving many lives. The aim of this research is to increase the lead time by developing a machine learning based mathematical prediction model that is able to compute the probability for food insecure areas by learning from historical data.

For performing such computations, our prediction model is developed and trained on historic open access data for the Horn of Africa (2009-2018). We used precipitation and vegetation data derived by remote sensing, as well as socio-economic, medical, armed conflict and disaster data. To overcome spatial inconsistencies in the input data and to meet the requirements of spatially homogenous input for neural networks, all data has been converted to geo-referenced raster maps. Disaster and armed conflict data has been fitted to districts while local food market prices have been interpolated. The IPC (Integrated Phase Classifier) has been used as the food security label.

In order to find a prediction model, new generation deep learning methods have been used [1]. While most approaches generally focus on a single type of neural network, we have decided to combine Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) as proposed by Interdonato et al. [2]. This allows us for combining both of their strengths such as the spatial autocorrelation of the CNNs, and the ability to address for temporal dependencies in remote sensing data by RNNs. Several analyses were applied on the collected data such as multicollinearity, cluster and principal component analyses. Evaluation of our method was performed using cross-validation (70/30 data split) and machine learning metrics (F1-Score, OA, MCC).

# Assessing climate variability and simulated crop yields of double-cropping systems in Mato Grosso, Brazil

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**Keywords:** Cropping systems, agricultural practices, climate variability, biophysical constraints, risk management

## ABSTRACT

The Mato Grosso (MT) is one of the main crop-producing states in Brazil and the largest producer of soybean, maize, and cotton. The paper objectives were (1) to evaluate how does temperature and precipitation changes over the years and macro-regions in MT, and (2) to assess the performance of crop yields in response to different biophysical constraints in MT. For the descriptive analyses of climate variability, the weather dataset was taken from the Brazilian National Institute of Meteorology, containing temperature and precipitation in daily resolution from 1999-2015 and for five municipalities [2]. Crop yields were simulated using the MONICA software, a dynamic crop growth model calibrated to the crops and climatic conditions in the study area [3;4] and considering site-specific biophysical conditions. The yields were decomposed into different macro-regions, soil types, nitrogen (N) amounts, maturity groups (MG) and sowing dates. The climate variability results show that Northeast and South Central regions presented the higher temperatures. The onset usually starts on November 05<sup>th</sup> and the cessation on April 10<sup>th</sup>. Mid North region showed an early onset and a late offset. On West region, the rainy period comes later and on South Central, the dry season comes early. Soybean achieved higher yields on later sowing dates, between October 15<sup>th</sup> and November 1<sup>st</sup> and it increased with longer maturing cycles. Due to the crop rotation scheme and the rain-fed system in MT, maize and sunflower yields were higher when sowed on early dates. High yields were simulated for maize, cotton, and sunflower on Ferrasol Dystrophic soil type, whereas Acrisol Dystrophic showed a rather low performance among all crops. Maize and sunflower showed significant increases in yields until 80 and 60 kg ha<sup>-1</sup> of N, respectively. Mid North region reported the highest yields for soybean, maize, and cotton while South Central presented the lowest yields for maize, cotton, and sunflower. In a rainfed cropping system as it is in MT, a crop with heat and drought tolerant characteristics, like sunflower, could be a satisfying option to resist the climatic conditions of the season than the other crops grown in the state.

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# Effect of climate change on the yields of rein-fed agricultural systems in Mato Grosso

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**Keywords:** climate change, yield simulation, Mato Grosso

## ABSTRACT

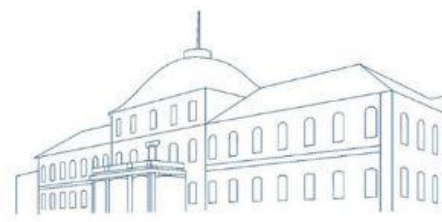
Mato Grosso (MT) is Brazil's most important domestic producer of soybean, maize and cotton. Rising temperatures and water stress, however, pose an increasing challenge for rain-fed agricultural production systems [1,2]. This study aims to assess the effect of two potential climate change scenarios on the temperature, precipitation and yields for 2020-2039.

To show the effect of the climate change scenarios on the weather patterns, we perform a descriptive analysis of two climate projections based on the Statistical Analogue Resampling scheme (STAR) and the Weather Research and Forecasting Model (WRF) respectively, provided by the University of Hamburg [3]. Of the two scenarios, STAR projects a more extreme climate change. Yield responses to climate change were assessed by the Model for Nitrogen and Carbon in Agro-ecosystems (MONICA), a process-based crop growth model [4]. We analyze the yield change of sunflower, soybean, maize and cotton for different agricultural practices with regard to five macro-regions of MT, different sowing dates, amount of nitrogen fertilization, soil types, and maturity groups (MG).

The effect on climate patterns and yields differ considerably between the scenarios. The yearly average temperature rises between 0.9°C (WRF) and 1.3°C (STAR). The onset of the rainy season is delayed in both scenarios and the transition from dry to rainy season becomes less distinctive. This leads to median yield changes of +3.06% (WRF), and -30.79% (STAR). The most favorable yield change in WRF (STAR) experiences soybean (sunflower) with median yield change of +6.71% (-27.75%). Cotton shows the highest median yield losses with -4.84% (WRF) and -46.6% (STAR). Increased water stress decreases the positive relationship between nitrogen-fertilization and yields in STAR. Similarly, the difference between yields of the early and late sowing dates decreases significantly for maize and sunflower in both scenarios. In WRF, the median soybean yields of all maturity groups increase. The positive change decreases gradually from MG VII to MG IX.

As a possible mitigation strategy we find in WRF the utilization of increased nitrogen applications. Due to the high losses in Southeast under STAR, it is highly questionable if the production there will remain feasible.

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Abstracts

**Session C4**

**Human environment interaction**

# Sustainable human environment interaction: Time for action

Prof. Juliana Gardenalli de Freitas (Universidade Federal de São Paulo)

We, as humankind, transform the environment to supply our needs, such as supporting larger populations, technology development and the search for a different lifestyle. Our development over time has increased our capability to impact the environment. According to the Millennium Ecosystem Assessment (2005), since 1950 the changes in ecosystems due to humankind were more rapid and extensive than in any previous period. The awareness of environmental degradation started to grow and became significant at the beginning of the 21<sup>st</sup> century. We recognized that ecosystem services are under significant threat, and that changes in ecosystems are more likely to be abrupt and potentially irreversible (Millennium Ecosystem Assessment, 2005). This awareness brings a pessimistic view of the human environment interaction, in which humans have catastrophic impacts on the environment.

From that situation, a more optimistic perspective emerges which is reflected on the sustainable development concept. It represents our trust that humankind and the environment can coexist. The sustainable development goals are a guide to what we hope to achieve, but we need to act to get there. Our responses should consider that the sustainable development goals are interconnected and need an interdisciplinary perspective to be successful.

The change in perspective brought by the sustainable development concept reached different fields, such as contaminated sites management. The framework for contaminated sites has evolved from remediation to background levels to a sustainable land management approach. However, not all countries are at the same stage. In Brazil, most remediation techniques for contaminated sites management are selected without consideration for resources consumption, atmospheric emissions, and social aspects. There is a lot to be gained by exchanging technologies, practices and ideas between countries and between environmental fields. We should not only foster this exchange but take practical steps to act in a coordinated way as soon as possible. We are facing a global challenge; we need to act together to be able to achieve the sustainable development goals.

# **A Critical Review of ASSM and Industrial Mining in the Amazon Rain Forest over Time**

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**Keywords:** Amazônia, Mining activities, Impacts

## **ABSTRACT**

Mining activities in the Amazon Rain Forest date back to the early 20th century comprising exploration projects for metallic, non-metallic and energetic resources, when international and national mining companies began to prospect, explore and exploit. ASSM (artisanal-small-scale-mining) of gold and other mineral substances began in the Amazon Region as early as the 16th century in more easily accessible locations close to the coasts and major rivers.

There are currently over 30 million people living in the Amazon region, an area of more than 7 million square kilometers, and they all have to make their livelihood somehow. While economic activities such as agriculture and cattle farming require large areas, and only a handful of workers are involved, this is not the case in mining, whether in small or industrial dimensions.

Any kind of productive activity performed by humans has been causing impacts, since ever. Ecological, economic, social and environmental facts, instead of contents in subjective reports, as they are almost always given by the media, and thus give false impressions, are to be objectively shown here. Thus these facts might be serving as an approach to highlight past improvements, and pointing out the need for solving remaining problems, as well as developing suggestions or ideas for their solution.

# Surface Water-Groundwater Exchange: Nature's Water Purifier

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**Keywords:** water treatment, surface water, groundwater, hyporheic exchange

## ABSTRACT

Water is susceptible to contamination from various anthropogenic activities (e.g., untreated wastewater, mining, agriculture, chemical manufacturing, road salting). As well as modern emerging contaminants such as micro-plastics and pharmaceuticals, whose long-term environmental impacts are unknown and areas of intensive scientific research.

Purifying water through engineering approaches can be costly, but there are natural processes that can help. For instance, water that travels through the ground has the potential to undergo biogeochemical reactions in the subsurface. Thus, removing contaminants and restoring water quality naturally. The process in which river water is driven into the subsurface, mixes with groundwater, and subsequently returns to the river is known as *hyporheic exchange*. The distribution of hyporheic exchange residence times (the time taken for water to move through the subsurface) is an important factor when determining the magnitude of potential biogeochemical reactions<sup>[1]</sup>. In other words, catchments can potentially act as chemical reactors or natural filters of pollutants because of hyporheic exchange<sup>[2]</sup>.

Since 2010, we have been investigating surface water – groundwater exchange within the Steinlach River, a tributary of the Neckar River in southwest Germany that receives treated wastewater. Recently, our team has been investigating the effects of riverbed elevation (bathymetry) on surface water-groundwater exchange. Through the development of a 3D surface water-groundwater model of a meandering section of the Steinlach River we have found that having a highly-resolved bathymetry, which includes the detailed undulations of small-scale bedforms, leads to multiple scales of hyporheic exchange that are nested within one another.

Our results indicate that a lack of bathymetry detail can lead to overestimates of hyporheic residence times<sup>[3]</sup>. This can result in gross biases when calculating the catchment's capacity to act as a reactor to attenuate pollutants. With our new understanding we hope to equip river ecologists, and civil/environmental engineers with the mental tools required to preserve and maintain high-quality water within our rivers.

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# **A Global Voice for Survival: An Ecosystemic Approach for Advocacy, Communication, Public Policies, Research and Teaching Programmes**

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**Keywords:** politics, economics, ecosystems, education, environment

## **ABSTRACT**

In view of environmental conditions, quality of life and the state of the world, an ecosystemic approach is posited to define and deal with the problems in the core of the "boiling pot", where the problems emerge, instead of reducing them to the 'bubbles' on the surface (effects, fragmented, taken for granted issues).

Contrariwise to disjointed public policies, teaching and research reduced formats, tendentious media communication and advocacy, the ecosystemic approach addresses the general phenomenon, the state of the world; quality of life, ethics, biocultural, environment conditions are considered altogether.

Instead of taking current prospects for granted and projecting them into the future (exploratory forecast), the definition of desirable goals (normative forecast), and the exploration of new paths to reach them is founded on the understanding of the dynamics that create and sustain lock-ins and barriers to change.

In the ecosystemic approach, all dimensions of being in the world (intimate, interactive, social and biophysical) are combined in the diagnosis and prognosis of the problems, in view of their complementarity and mutual support, as they intermingle to elicit the events and organize for change.

The key challenges are conceptual, more civic and political than technical: conceptualize sustainability from a holistic, interdisciplinary approach; support a long-term strategy based on political, economic, environmental and societal commitments towards new dynamics of global governance.

Institutional capacity, judicial neutrality, informational transparency, social spaces for civic engagement are the main factors to assign public resources to conservation programs and policies in view of the framing of different values (use vs. preservation; ecosystem services vs. species).

In the ecosystemic approach, socio-cultural learning niches (as new structures, protective spaces for "path breaking innovations"), develop awareness, interpretation and understanding beyond established stereotypes, "shielding, nurturing and empowering", in view of a thematic ("what"), an epistemic ("how") and a strategic (when, who) point of view.

Scholars, academicians, students, activists, policy-makers and practitioners should work together towards new paradigms of growth, power, wealth, work and freedom embedded into the cultural, social, political and economical institutions.

The proposal favours societies that invest in each other, not in mega-projects with intensive use of resources.

# Carbon ( $C_t$ , $C_{org}$ ), nitrogen ( $N_t$ ) and sulfur ( $S_t$ ) dynamics in Amazonas soils – some surprises

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**Keywords:** terra firme, soil biogeochemistry, climate change, hydrological gradient

## ABSTRACT

Data-based knowledge on carbon and nitrogen concentrations and their pools as well as on possible intra-annual dynamics are needed to better understand Amazon basin-internal (7.5 million km<sup>2</sup>) dynamics, increasing anthropogenic strain on this large biome, and its global role as one of two continental biospheric tipping elements.

Total and organic carbon ( $C_t$ ,  $C_{org}$ ), nitrogen ( $N_t$ ) and sulfur ( $S_t$ ) concentrations were quantified in litter (ORG) and mineral soil material (TOP 0–20 cm, BOT 30–50 cm) of upland (terra firme) oxisols across Amazonas state. We present a first pool calculation. Data are based on triplicate seasonal sampling at 29 sites (forest: FOR and post-forest: PF) within the binational project EcoRespira-Amazon (ERA): <https://blogs.hrz.tu-freiberg.de/ecorespira/>. Repeated sampling allows for interpreting intra-annual (seasonal) and climate change-related dynamics. Extreme conditions between the dry season in 2016 and the subsequent wet season (ENSO event) pronounced differences.

Median concentrations in the basin for TOP soils are ( $C_t$  1.9,  $C_{org}$  1.6,  $N_t$  0.15,  $S_t$  0.03 wt% under forest canopy) as well as  $C_{org}/N$  ratios similar to average European soils (FOR-EGS, GEMAS). TOP  $C_t$  concentrations ranged from 1.02 to 3.29 wt% (medianFOR 2.17 wt%; medianPF 1.75 wt%),  $N_t$  from 0.088 to 0.233 wt% (medianFOR 0.17 wt%; medianPF 0.09 wt%) and  $S_t$  from 0.012 to 0.051 wt% (medianFOR 0.03 wt%; medianPF 0.02 wt%).  $C_{org}/N$  ratios ranged from 6 to 14 (median 10).

Forest versus post-forest changes are illustrated by a first pool calculation (hectare-based). The central part of the basin (Amazonas graben) generally shows higher CNS values as compared to its southern part. Deforestation and drought conditions lead to C and N losses. C and N losses average 10 to 15 % within 50 years after deforestation. Regional climate change with increased drought will likely speed up carbon and nitrogen losses.

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# **Cycling cities and sustainable urban development: challenges for Caraguatatuba, SP, Brazil**

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**Keywords:** Cycling system, sustainability, urban development, 2030 Agenda, characterization.

## **ABSTRACT**

The municipality of Caraguatatuba has the largest population of the north coast of São Paulo. According to the 2010 census and trend of population growth of the municipality, the current population is estimated at 119,625 inhabitants, being more expressive between 1991 and 2010 with the increase of 52,878 for 100,840 inhabitants. However, public transportation is not accessible in every neighborhood. As the urban area is flat, the use of bicycles as a means of transportation is intense. Then, the need for an efficient bicycle system is linked to the Sustainable Development Objectives of the 2030 Agenda.

The purpose of this study was to evaluate the cycling system in Caraguatatuba, identifying its current technical fragilities. At the beginning of the study, a survey was elaborated in a virtual platform. The structure of the research was based on the following assumptions: 1) user characterization - user age and gender, motivation for bicycle use, weekly frequency and estimated period of use; 2) verification of the degree of importance - analysis of the use of bicycles as an alternative or essential means of transportation on a daily basis 3) evaluation of the technical parameters - paving, lighting, safety, signaling, drainage, maintenance, design, accessibility and integration with other modes, in the scales from 1 (insignificant) to 5 (very good). The total of 70 users participated in the survey. Among the main results, it was verified that: 75% use the bicycle at least twice a week, and 80.3% use it during the day; 85% use it from 30 minutes to 1 hour, showing that the use for small distances in daily life prevails; 67.1% suggested improvements in paving, drainage, maintenance, signaling and safety. The second part of the study was based on field evaluation of the main routes. From the collected data, it was possible to verify that the Caraguatatuba bicycle system is widely used, but needs significant improvements in all the analyzed parameters. A final map was produced, where each segment of 100 m of the main routes was scored, using both individual parameters and the average of all features.



## **Cycle Infrastructure and the impacts over the bicycle use in Passo Fundo**

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**Keywords:** Cycle Lane - Environment - Urban Mobility - Infrastructure

### **ABSTRACT**

Based on the new urban mobility trends, the promotion of reflections on the use of motorized vehicles and the approach on infrastructure, were crucial to relate the impact of bicycle use in the city of Passo Fundo-RS and its environment. To reach the objectives, the data were extracted from papers, statisticians analyses and municipality meetings, among the factors that demonstrate the failure of the privilege in motorized transportation are the investments and the legislation over the environment. Today, the main actions seeking for a mobility change are common in the main Brazilian cities, specially due to the fact that the Brazilian elite fleet has grown 400% in ten years, according to FGV (Fundação Getúlio Vargas), in a perspective realized in 2016. In this way, Passo Fundo has everything that a big city have and also works with 11 kilometers of bike path, along Avenida Brasil, in the Boqueirão Av. Presidente Vargas in the Vila Rodrigues neighborhood. The bicycle transport system is a crucial element of the new ways for the circulation, parking and storage of bicycles on public thoroughfares and spaces for public use. Taking a deeper look at the comprising: bicycle lanes, cycle paths, shared bicycle use spaces with other modes, including pedestrians, bicycle and paracycles. After a qualitative-descriptive analysis of the data, it was observed that cycling for leisure induced the use of the bicycle as a means of transport, but not as the ideal. However, the use as a daily locomotion way by the population, being was verified that there are other factors that make it difficult to see the connections as a local infrastructure. Those factors analyzed together with the interaction between the man and the environment, showed that the users try to enjoy the green landscape as themselves. Although they are still repressed by the individualistic model of transport, the comfort of their own vehicles and the gap of culture for green locomotion are pointed as causes.

# Life Cycle Inventories of Small-Scale Gold Mining in the Amazonian Rainforest in Brazil

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**Keywords:** Life Cycle Assessment, environmental impact, artisanal small-scale mining, gold, Brazil

## ABSTRACT

Gold, like hardly any other material, has formed and destroyed civilizations, triggered emotions and is a symbol of wealth and success. It moves people to the remotest areas and leaves ghost towns. But gold, creates negative impacts that are of great importance - resource depletion, extensive use of chemicals, toxic emissions, high energy consumption as well as social concerns just to name a few. One of these remote areas is the Amazonian rainforest. Here Gold is mostly extracted with artisanal small scale mining (ASM), small operations of 1-5 people with very rudimentary tools, called Garimpos. In this study primary data regarding the use of resources (e.g. fuel, land or mercury) of gold from ASM was gathered in the Tapajós Region in Brazil. It was possible to gather data on various types of gold extraction methods including alluvial mining with hoses and sluice boxes (hydraulic mining), underground mining with and without cyanidation and dredges. As an exemplary excerpt for one area the evaluation of gathered data from seven hydraulic mining Garimpos results in an average mining area of 3200 m<sup>2</sup>, 0.53 kg Gold, 6400 kg-diesel and 0.66 kg-mercury for a functional unit of 1 kg-gold. One well-established method to analyze environmental impacts along the life cycle of products is Life Cycle Assessment (LCA). In LCA databases as of today there is no data on ASM. Several similar studies [1, 2] have been conducted in other countries since the first study by Valdivia has been published in 2011 [3]. We hope this data lack can be closed by studies like this. Another interesting outcome is a comparison of relevant impact categories like cumulative energy demand, land-use, biodiversity loss and mercury emissions of industrial vs. ASM mines.

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## **Monitoring and evaluating sustainable territorial development in the Brazilian Amazon: the experience of Instituto Terroá**

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**Keywords:** Monitoring, evaluation, territorial development, value chains, Amazon rainforest

### **ABSTRACT**

Few other places on earth are as crucial for the stability of global climate, the conservation of the world's biodiversity, and the survival of the human species on the planet as the Amazon. The largest tropical rainforest in the world also houses a great diversity of local communities, whose livelihoods depend on the sustainable use of the land and the resources of the Amazon biome. Protecting such a vital biome is thus inextricably linked to the strengthening of sustainable value chains and the promotion of local communities' rights and well-being. Instituto Terroá, a Brazilian non-governmental organization (NGO) based in the state of São Paulo, has worked toward these goals since 2015. It has done so not only by fostering community-based forestry businesses and developing leaders for sustainable development, but also by designing and applying technologies to evaluate human and natural dimensions of territorial development in the Brazilian Amazon. Therefore, the purpose of our poster presentation at the 9th Brazil-Germany Symposium on Sustainable Development is to share Instituto Terroá's experience in designing and applying assessment tools to monitor and evaluate territorial development and value chain maturity in Amazonia. The poster presentation will focus on two assessment tools Terroá has applied with communities of two Amazon territories in Brazil's northern state of Amapá (Arquipélago do Bailique and Beira-Amazonas): the Sustainable Territorial Development Assessment System and the Community-Based Business Maturity Scale. Combining participatory processes with digital tools, assessment technologies like these not only provide a holistic and integrative approach to human and territorial development, but also might be powerful instruments to strengthen community organizations, ensure differentiation and traceability of biodiversity product chains, and spot priority areas to NGO action. Moreover, they might play a crucial role in informing decision-making within communities themselves and supplying evidence-based advice to public policymaking. Sharing our experience, receiving feedback from an international audience of scholars and practitioners, and reflecting on the implications of our work to the governance of sustainable development in the Brazilian Amazon are at the core of our interest in applying to attend this year's symposium.

# **The green infrastructure relation on the campus I of the university of Passo Fundo with the quality of learning**

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**Keywords:** Green infrastructure; Users Perception; Environmental Education.

## **ABSTRACT**

The understanding of the process of designing green infrastructure spaces and their importance in social dynamics are related to the ability to integrate functions, characteristics, values and the sense of belonging that are generated in those individuals. In this sense, the present article carried out a study of users' perceptions regarding the green infrastructure present in the Campus I of the University of Passo Fundo, located in the city of Passo Fundo, RS, Brazil, under the post occupation assessment bias. The Campus has Permanent Preservation Areas (PPAs), lakes, plains, grassy areas with vast shading and decorative landscaping with shrub and native and exotic flower species. To develop such assessment, the questionnaire method was used to focus on people who attend the environment, mainly academics, in order to understand how users take ownership of the space, the potential of the place and the benefits that the green spaces bring for the quality of learning. The results were obtained through the analysis of these questionnaires with the maps of green areas of the campus, which were essential to confirm the relationship in which the students of Campus I maintain with the wooded environments present in the place. It was evidenced from this research the clear importance of the green spaces in the Universities and Institutions, as potentializers of teaching, where the quality of the environment influenced directly in the productivity and performance of the academic, resulting in a more qualified and at the same time pleasant formation. In addition, it was highlighted the relevance of the study as a means of feedback to the process of designing green spaces, both in public and private environments. This way demonstrating the importance and advantages of its adequate planning and implementation, as well as the possibility of detection of the green areas that bring better results to the social - educational scope.

# Biodiversity preservation and the conflict between criminal justice and traditional people: Bagre fishing in southern Brazil

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**Keywords:** Traditional people and communities, Environmental Law, Critical Criminology.

## ABSTRACT

The present research aims to identify the socio-legal consequences to traditional people and communities resulting from the prohibition of Bagre (*Genidens barbatus* and *Genidens planifrons*) fishing, common fish species in the southern region of Brazil, more specifically in rivers of the Delta do Jacuí region (Rio Grande do Sul, Brazil). Through the state law 51.797/2014, Bagre was included among an endangered species' list. As a consequence, Bagre's fishing became, among other legal consequences, a felony (art. 34, I, Federal Law n. 9.605/98), punishable by imprisonment, fines, as well as the production's confiscation. This measure directly affects traditional People and Communities of fishermen whose main economic activity was precisely this fishing. This prohibition has, in addition to other conflicts, a knowledge field dispute, given that, according to ethnographic studies already carried out, fishermen, empirically, did not notice a decrease in Bagre's populations, in a clear discrepancy between traditional and scientific knowledge. Based on the assumption that traditional fishing does not bring the same damage to the fish stocks on its own, and that the region's industrial activity strongly influences the river pollution, the following research problem is presented: conservation of biodiversity response should give the same treatment to artisanal fishermen and to other forms more aggressive to the existence of such animal? It seeks, therefore, to understand the contradictions between environmental legislation and traditional ways of life, without neglecting the necessary protection of biodiversity, in order to ascertain what responses, in addition to criminal, are possible for this situation and if, indeed, a criminal response to the question is required. In order to do so, it is based on criminology theories, which seek to understand the problems of this dynamic and, fundamentally, the effects of criminal law response in these artisanal fisherman communities. The narrated situation involves diverse social actors and consequences: legal, political, economic, social etc. The emphasis in this research is fundamentally the criminological one, that is: is it necessary (and effective) the action of criminal law in such intricate conflict?

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Abstracts

**Keynote Speakers**

**- Closing Ceremony -**

# **Conservation of Private Reserves in BRAZIL: The example of the Cristalino Lodge in the Amazon**

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**Keywords:** Rio Cristalino, RPPN, pioneer in ecotourism

## **ABSTRACT**

The movement of private properties in Brazil in order to preserve part or their entire land started in 1965 onwards, in an initiative of land owners who did not want hunting in their property, especially in the State of Rio Grande do Sul. In 18 July 2000, through the Federal Law number 9.985/2000 the "National System of Conservation Units"(SNUC), included the private reserves in the category of full protection, the same one as a National or State Park, aiming the protection of the biological diversity. The System of Conservation Units in Brazil is formed by a set of federal, state and municipal laws and it encompasses private owners, non-governmental organizations (NGOs), individuals and legal entities. The Private Reserves are registered in perpetuity in the Public Registry of Real State. The activities allowed in a private reserve are scientific research, ecotourism and environmental education. The advancement of environmental laws, the modern concepts of ecological corridors and mosaics demonstrate that the obligation of environmental protection competes not only to the public sectors but also to the collective. It started with a small movement and up to June 2019 we have reached 1.563 RPPNs in Brazil, summing up 888.060 hectares and the aim is to reach one million hectares soon.

The Cristalino Lodge located in a private reserve in Southern Brazilian Amazon represents the first one in the State of Mato Grosso. It started with 700 hectares, increased to 4.732 hectares in 2015, with other 2.502 hectares in approval, encompasses more than 7.000 hectares by the Cristalino River. Other areas under protection by Da Rivas family form a huge block of almost 12.000 hectares by Teles Pires River, 20% bigger than the island of Manhattan in the USA.

The pioneer movement of the Cristalino Lodge and the Cristalino Foundation, of bringing scientists to the region, started to prove the biological diversity of the region, and its endemism, due to its location between the Xingu and the Tapajós rivers in the Southern Amazon. In 2000 the State of Mato Grosso declared the Cristalino State Park, encompassing further 184.900 hectares which surround the Cristalino Private Reserves.

# 200 years the voyage of spix and martius thru brazil

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**Keywords:** Spix, Martius, Expedition, Journey in Brazil

## ABSTRACT

The zoological scientist, Johann Baptist von Spix and the botanical scientist Carl Friedrich von Martius initiated their voyage thru Brazil in dezember 1817 and returned to Europe in june 1820. Their objective was to discover a significant part of the interior of Brazil and to describe the nature of these part previously not cientificly analized, such as the biomas sertão and caatinga. The expedition is considered the most important made during de 19. century in Brazil.

The team of the Institut Martius-Staden, composed by Willi Bolle, Professor at the University of São Paulo and Eckhard E. Kupfer, Director of the Institut Martius-Staden, accompanied by two cameramen, initiated the first leg of retraveling the journey of Spix and Martius between Ouro Preto and Diamantina in march 2017, including a visit to the villages of Bento Rodrigo and Paracatú, which where affected by the dam-burst in 2015.

In July 2018 the second part of the voyage, including to cross the Sertão of Minas Gerais and comparing the reports the baverian cientists had made, with the environmental change of now a days. Interviews with local citizens were made.

In July 2019 the team will travel up the amazon river from Belém to Manaus visiting the cientific station ATTO in the Amazon jungle, which is maintained by the brazilian Research Institut for the Amazonas and the german Max-Planck-Institut.

It is intended to show in an additional documental picture the change in brazilian nature during these 200 years.

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# **The Global Assessment of IPBES (Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services) – towards Integrating Systems for Sustainable Development**

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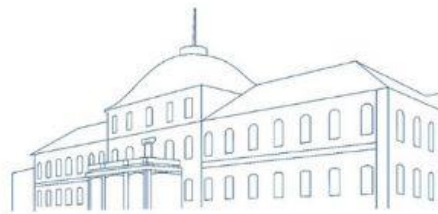
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**Keywords:** biodiversity, ecosystems, sustainable development

## **ABSTRACT**

One million species are threatened with extinction, more than ever before in human history, according to the Global Assessment of IPBES, which was accepted by the platforms plenary in May 2019. Ecosystems, species, wild populations, local varieties and breeds of domesticated plants and animals are shrinking, deteriorating or vanishing. This loss is a direct result of human activity and constitutes a direct threat to human well-being in all regions of the world. In descending order, the main direct drivers responsible for nature's decay are land- and sea-use change, direct exploitation of organisms, climate change, pollution, and invasive, alien species. Behind these are the indirect drivers which relate to our society and where a transformative change is needed in order to safeguard our and our childrens' future

Josef Settele, who co-chaired the new assessment together with Sandra Diaz (Argentina) and Eduardo Brondizio (Brazil/USA), will present some of its main outcomes and also share some insights on the process and the uptake so far.



Abstracts  
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## Be the Difference

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**Keywords:** Sustainability, ecological footprint, use of resources

### ABSTRACT

Sustainable, people-oriented company development is the central focus of our activities. Our primary goal is the creation of values for our customers, our employees and the company. In order to achieve this, we must deliver top performance in relation to sustainability. We are taking this responsibility very seriously in all divisions of the company. On the one hand with the continued existence of the company through successful products and an honest and reliable partnership with our customers, employees and suppliers. On the other hand with sustaining attractive working conditions, the reduction of the ecological footprint of our business activities and an efficient use of resources.

We are seriously committed to our social responsibility as a good corporate citizen. The group's sustainability management is controlled by a department of the same name. It is also responsible for environmental protection, energy efficiency and social standards in the supply chain. Environmental officers have been appointed at all 20 production and four logistics sites; they are the contact persons for sustainability management at their respective sites. They coordinate group-wide measures in the "CSR steering committee".

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## **Sustainable cocoa production as keystone method to conserve the Mata Atlântica biome in Southern Bahia**

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**Keywords:** Mata Atlântica, reforestation, cabruca, Golden-headed Lion Tamarin

### **ABSTRACT**

AMAP is a young German/Brazilian non-profit organization, founded 2016 in Germany and 2017 in Brazil. Our main goal is the conservation and restoration of the Atlantic Forest. The Mata Atlântica biome faced a decline of about 85% of its original extent, caused by a growing population of Brazil. AMAP acquires farmland which includes secondary and primary forest fragments and connects these fragments by a high diversity reforestation of degraded areas, mostly abandoned cattle pastures. Our project area is located within the cocoa coast of Southern Bahia, nearby Ilheus. Cocoa has been produced in this area for more than 200 years. The cocoa forests (Cabruças) represents an agroforestry system which is highly diverse. Cocoa trees grow in the shade of the forest canopy, only parts of the understory were removed. Cabruças generates an income for the local population and conserves the biodiversity by connecting forest fragments and functions as habitats for the native fauna. But this system is declining, caused by decreasing prizes on the markets and increasing yield losses due to pests and diseases. Numerous farmers replaces Cabruças by plantations of rubber trees, sugar cane or eucalyptus. Cabruças owned by AMAP, as part of purchased farmland, will be bio-certified (Demeter) and maintained as a sustainable agroforestry system, generating sufficient income for the local small holders and conserving a high biodiversity of native species. Therefore we are supporting and realizing scientific projects (as PhD or master thesis), which implements ecological intensification methods in the management of Cabruças aiming to enhance the cocoa yield and thus the income per hectare. Cabruças are inhabited by endangered species. Especially *L. chrysomelas* (Golden-headed Lion Tamarin) is abundant in our project area. AMAP supports and realizes scientific projects which aims to understand how species respond on different management and maintenance methods of Cabruças (abundance and diversity of shade trees, density of understory and lianas etc.). This insights will allow us to adapt the management of Cabruças to a biodiversity friendly and economically viable agroforestry system system.



## **Probing the turbulent transport in the atmosphere using small unmanned research aircraft (UAS)**

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**Keywords:** atmospheric boundary layer, unmanned aircraft systems, troposphere

### **ABSTRACT**

Small unmanned aircraft systems (UAS) are very appropriate instruments for the in situ investigation of the turbulent transport of heat, momentum, gases and particles in the troposphere, and especially in the atmospheric boundary layer (ABL). Due to their small size - when using the right design - the disturbing effect of fuselage and engine can be insignificant compared to manned aircraft. In general, small UAS are very flexible in operation, very mobile and do not require large crews or facilities. Thus UAS are very suitable measurement systems for smaller research teams, with smaller budget, like e.g. university groups. For many applications, UAS provide data sets much quicker and with less afford compared to numerical simulations, the installation of towers or remote-sensing units, and with a significantly higher accuracy and spatial resolution.

During the recent years, the Environmental Physics group at the University of Tübingen developed the research UAS MASC (Multi-purpose Airborne Sensor Carrier) for meteorological, wind-energy, and aerosol science. MASC operates automatically, not controlled by a human pilot at the ground, but by an on-board autopilot system, which allows for flights over larger distances, in remote areas (e.g. polar regions) or at places that are too dangerous for manned aircraft (e.g. volcanic activities). The vertical range of MASC starts at 30 m above ground up to 4000 m. With an endurance around 2 hours, the horizontal range is about 144 km. During horizontal flight, sub-meter spatial resolution is achieved (for wind vector and temperature, 2 meters for water vapor), while during slant vertical flights, the vertical resolution is in the centimeter range.

The latest iteration MASC-3 (total weight: 6 to 8 kg, wingspan: 4 m) is a very flexible research UAS which enables very precise and save flight patterns (no deviation larger than 2 m in any direction) together with a great reliability and safety. MASC systems (and its precursors) were already deployed in various research projects and (international) field campaigns for fundamental and applied science funded by the German science foundation DFG and the BMWi (German Federal Ministry for Economic Affairs and Energy) since 2005. MASC systems have been successfully operated under harsh conditions, in polar regions (Svalbard, Northern Finland), in complex terrain and off-shore (e.g. from Helgoland), at wind speeds up to 24 m/s.

## **Discover your potential and opportunities in Baden-Württemberg**

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### **ABSTRACT**

Baden-Württemberg International (bw-i) is the centre of competence of the State of Baden-Württemberg for internationalization, promotion and development in the areas of industry and services as well as science and research. Baden-Württemberg International markets the State's business, education and research opportunities both within Germany and abroad. It supports companies, universities and research institutions in setting up international cooperation and recruiting qualified staff, assists foreign companies investing in Baden-Württemberg and conducts projects in selected target countries. Baden-Württemberg International is also the first point of contact in these areas for all kinds of requests from home and abroad.

Baden-Württemberg, the German Southwest, is the EU's top region for innovation. When it comes to its research expenditure, amounting to 5.6 per cent of GDP (2017), Baden-Württemberg also occupies a leading position in Europe. The innovativeness of business and industry is supplemented by a dense network of universities, research institutions and transfer agencies. Many leading German institutions such as the Fraunhofer-Gesellschaft or the Max-Planck-Gesellschaft have substantially more facilities in Baden-Württemberg than in any other state in Germany. Baden-Württemberg has an excellent and Germany's most diverse landscape of higher education and research. There are more than 70 universities and over 100 non-university research institutions in the southwest. Teaching and research are conducted on the very highest level.

For more information visit [www.bw-studyguide.de](http://www.bw-studyguide.de) or [www.bw-career.de](http://www.bw-career.de).



## **The German Centre for Research and Innovation São Paulo (DWIH São Paulo)**

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**Keywords:** network, science and innovation landscape

### **ABSTRACT**

The DWIH São Paulo is part of a network of the German centres for research and innovation, coordinated by DAAD and founded by the German Federal Foreign Office. It provides a joint platform for German scientific organisations and research-based companies, showcases the capabilities of German research and connects German innovators with Brazilian cooperation partners.

The DWIH São Paulo aims to:

- Promote Germany as a land of ideas and innovation, academic and scientific research.
- Connect German and Brazilian scientific institutions and support the initiation, expansion and consolidation of cooperation projects.
- Act as a platform for individual and joint actions of German higher education, research and innovation institutions and research-based companies in Brazil.
- Provide guidance to Brazilians interested in studying and researching in Germany, or cooperating with German research and innovation groups.
- Provide information to German institutions on the science and innovation landscape in Brazil.



## **The STIHL Group, Waiblingen**

ANDREAS STIHL AG & Co. KG

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**Keywords:** forestry, agriculture, landscape maintenance, corporate social responsibility

### **ABSTRACT**

The STIHL Group develops, manufactures and distributes power tools for professional forestry and agriculture as well as for garden and landscape maintenance, the construction sector and private garden owners. The product range is complemented by digital solutions and services. Products are distributed exclusively through authorized dealers, including 38 sales and marketing subsidiaries, about 120 importers and more than 50,000 servicing dealers in over 160 countries. STIHL produces in own plants in seven countries: Germany, USA, Brazil, Switzerland, Austria, China and in the Philippines. Since 1971 STIHL has been the world's top-selling chain saw brand. The company was founded in 1926 and is based in Waiblingen near Stuttgart. In 2018, STIHL achieved a worldwide sales volume of 3.78 billion euros with a workforce of 17,122.

Corporate responsibility has a long tradition at STIHL. As a medium-sized family-owned company, we believe we have a special obligation to society. We fulfill this obligation in many ways, for example with voluntary social benefits for our employees, with attractive apprenticeships and traineeships, and with social involvement close to our sites. Continuity and a long-term view guide our actions, and are part of our understanding of sustainability, just like resource-conserving production and the STIHL products with built-in environmental protection. The focal points of our social responsibility are in the areas of sustainable business operations, employees, the environment and education.

As a leading global manufacturer of chain saws and power tools for forestry and agriculture, gardening and landscape maintenance as well as the construction industry, STIHL has a special ecological responsibility. This applies to all areas, from our products and processes right up to supporting environmental initiatives and projects.





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