



# 4th World Congress on Agroforestry

20-22 May 2019  
Montpellier, France

## Book of Abstracts



Under the High Patronage of  
Mr Emmanuel MACRON  
President of the French Republic



**4th World Congress**  
on **Agroforestry**

20-22 May 2019  
Le Corum - Montpellier, France



The views expressed in this publication are those of the author(s)  
and not necessarily those of the Organisers.

Articles appearing in this publication may be quoted or reproduced without charge,  
provided the source is acknowledged.

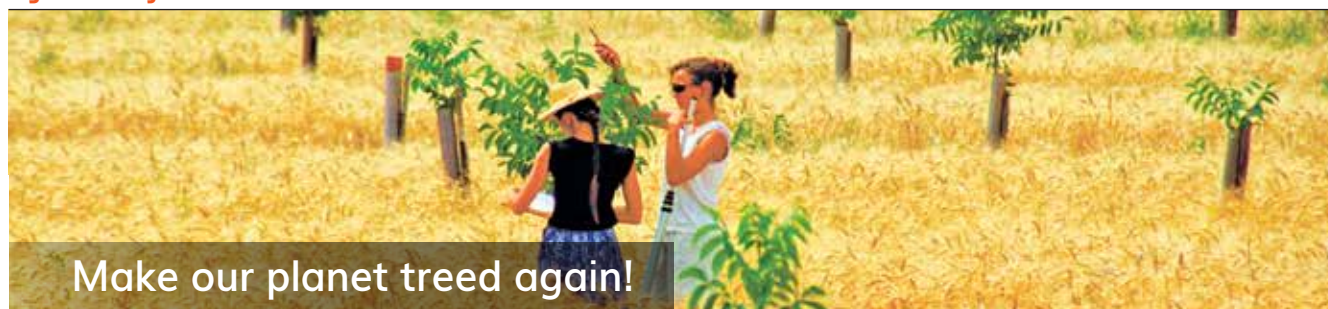
All images remain the sole property of their source and may not be used  
for any purpose without written permission of the source.

Suggested citation: Dupraz, C., Gosme, M., Lawson, G. (Editors). 2019.  
Book of Abstracts, 4<sup>th</sup> World Congress on Agroforestry.  
Agroforestry: strengthening links between science, society and policy.  
Montpellier: CIRAD, INRA, World Agroforestry. 933 pages.

Compiled by Alpha Visa Congrès

Edited by Christian Dupraz, Marie Gosme and Gerry Lawson with  
the members of the Scientific Committee of the Congress.

Design and layout by Alpha Visa Congrès



Measuring young trees in an agroforestry plantation, Restinclières, Hérault, France

© C. Dupraz

## TABLE OF CONTENTS

■ Welcome address.....	IX
■ Committees .....	X
■ Organisers.....	XII
■ Sponsoring partners and exhibitors.....	XIII
■ Overall programme .....	XIV
■ Programme on Sunday 19 May .....	XVII
■ Programme on Monday 20 May .....	XVII
<i>Plenary sessions</i>	
■ Programme on Tuesday 21 May .....	XXI
<i>Parallel sessions</i>	
■ Programme on Wednesday 22 May .....	XXXVI
<i>Parallel sessions &amp; Plenary sessions</i>	
■ Programme on Thursday 23 & Friday 24 May .....	XLIV

## Abstracts of Parallel sessions

<b>L1</b> Mitigating climate change with agroforestry .....	<b>1</b>
<i>Posters.....</i>	22
<b>L2</b> Agroforestry and adaptation to climate change.....	<b>55</b>
<i>Posters.....</i>	75
<b>L3</b> Agroforestry for combating land degradation and desertification in dry areas .....	<b>106</b>
<i>Posters.....</i>	116
<b>L4</b> Agroforestry and biodiversity conservation.....	<b>140</b>
<i>Posters.....</i>	161
<b>L5</b> Agroforestry for water quality and watershed restoration .....	<b>195</b>
<i>Posters.....</i>	206
<b>L6</b> Social issues in Agroforestry systems (gender, migration) .....	<b>213</b>
<i>Posters.....</i>	224
<b>L7</b> Jobs, business, finance: can agroforestry make it great?.....	<b>229</b>
<i>Posters.....</i>	239
<b>L8</b> Scaling up of agroforestry innovations .....	<b>248</b>
<i>Posters.....</i>	259
<b>L9</b> Value chains and certification of agroforestry systems and products .....	<b>283</b>
<i>Posters.....</i>	294
<b>L10</b> Agroforestry in practice .....	<b>311</b>
<i>Posters.....</i>	332

## Abstracts of Parallel sessions

<b>L11</b>	Agroforestry in public policies .....	<b>398</b>
	Posters.....	409
<b>L12</b>	Economics of agroforestry: the link between nature and society.....	<b>426</b>
	Posters.....	447
<b>L13</b>	Socio-economic and cultural constraints on technology adoption in agroforestry systems .....	<b>466</b>
	Posters.....	486
<b>L14</b>	Agroforestry landscapes .....	<b>511</b>
	Posters.....	522
<b>L15</b>	Urban and peri-urban agroforestry for food and nutritional security .....	<b>546</b>
	Posters.....	557
<b>L16</b>	Agroforestry mapping .....	<b>559</b>
	Posters.....	569
<b>L17</b>	Challenges, opportunities and trade-offs of agroforestry with perennial crops (coffee, cocoa, rubber, vineyards, orchards...).....	<b>585</b>
	Posters.....	605
<b>L18</b>	Cereals and annual crops in agroforestry.....	<b>644</b>
	Posters.....	655
<b>L19</b>	Silvopastoral system: promoting rural development by increasing tree-animal-pasture relationships.....	<b>678</b>
	Posters.....	688
<b>L20</b>	Agroforestry and agroecology: opportunities and challenges.....	<b>716</b>
	Posters.....	727
<b>L21</b>	Agroforestry germplasm .....	<b>744</b>
	Posters.....	755
<b>L22</b>	Agroforestry: pests, diseases and weeds .....	<b>782</b>
	Posters.....	793
<b>L23</b>	Root issues in agroforestry .....	<b>800</b>
	Posters.....	811
<b>L24</b>	Biophysical modelling of interactions in agroforestry .....	<b>818</b>
	Posters.....	829
<b>L25</b>	Open Session.....	<b>848</b>
	Posters.....	858
<b>■</b>	<b>Authors' Index .....</b>	<b>874</b>

## COMMITTEES

## Scientific Committee

- **Christian Dupraz (chair)**, INRA, France
- **Marie Gosme (co-chair)**, INRA, France
- **Gerry Lawson (co-chair)**, Centre for Ecology and Hydrology, Edinburg, UK / Spain
- Richard Asare, IITA, Ghana
- George Ashiagbor, KNUST, Ghana
- Jacques Avelino, CIRAD, France
- Jules Balaya, World Agroforestry, Kenya
- Robert Borek, Institute of Soil Science and Plant Cultivation - State Research Institute in Puławy, Poland
- Simone Borelli, FAO, Italy
- Antonio Brunori, PEFC, Italy
- Louise E. Buck, Cornell University, USA
- Paul Burgess, Cranfield University, United Kingdom
- Georg Cadisch, University of Hohenheim, Germany
- Rémi Cardinael, CIRAD, Zimbabwe
- Delia Catacutan, World Agroforestry, Vietnam
- Rolando Cerda, CATIE, Costa Rica
- Paxie Chirwa, University of Pretoria, South Africa
- Nathalie Cialdella, CIRAD, French Guiana
- Carol Colfer, CIFOR, USA
- George Curry, School of Design and Built Environment, Curtin University, Australia
- Hubert de Foresta, IRD, France
- Olivier Deheuvels, CIRAD, Peru
- Marlène Elias, Bioversity International, Italy
- Laurène Feintrenie, CIRAD, Costa Rica
- Nuria Ferreiro-Domínguez, University of Santiago de Compostela, Spain
- Kiros Meles Hadgu, World Agroforestry, Ethiopia
- Michael Jacobson, Penn State, USA
- Patrick Jagoret, CIRAD, France
- Ramni Jamnadass, World Agroforestry, Kenya
- Shibu Jose, School of Natural Resources at the University of Missouri, USA
- Anthony Kimaro, World Agroforestry, Tanzania
- B. Mohan Kumar, Nalanda University, India
- Cheppudira Ganapathy Kushalappa, Dean, College of Forestry, Ponnampet, India
- Richard Laity, Laos
- Norbert Lamersdorf, Forest faculty of the Göttingen University, Germany
- Rodel Lasco, World Agroforestry, Philippines
- Bohdan Lojka, Czech University of Life Sciences in Prague, Czech Republic
- Alejandra Martinez, CATIE, Costa Rica
- Delphine Meziere, INRA, France
- Geneviève Michon, IRD, France
- Peter Akong Minang, World Agroforestry, Kenya
- Gerardo Moreno, University of Extramadura, Spain
- Maria Rosa Mosquera-Losada, University of Santiago de Compostela, Spain
- Betserai Isaac Nyoka, World Agroforestry, Malawi
- Maren Oelbermann, School of Environment, Resources and Sustainability, University of Waterloo, Canada
- Alain Olivier, Faculty of Agricultural and Food Sciences at Université Laval, Canada
- Joao Palma, University of Lisboa, Portugal
- Anastasia Pantera, TEI of Central Greece, Greece
- Joana Amaral Paulo, ISA, Portugal
- Eric Penot, CIRAD, France
- Andrea Pisanelli, National Research, Council of Italy, Italy
- Tobias Plieninger, Universities of Göttingen & Kassel, Germany
- Ravi Prabhu, World Agroforestry, Kenya
- Valentina Robiglio, World Agroforestry
- Adolfo Rosati, CNR-IBAF, Italy
- Diaminatou Sanogo, ISRA, Sénégal
- Jean-Pierre Sarthou, INP-ENSAT/INRA, France
- Sara Scherr, EcoAgriculture Partners, USA
- Josiane Seghieri, IRD, France
- Fergus Sinclair, World Agroforestry, United Kingdom
- Virendra Pal Singh, World Agroforestry, India
- Jo Smith, Organic Research Centre, United Kingdom
- Eduardo Somarriba, CATIE, Costa Rica
- Raju Soolanayakanahally, Agriculture and Agri-Food, Canada
- Alexia Stokes, INRA/AMAP, France
- Hesti Tata, FOERDIA, Indonesia
- Naresh Thevathasan, University of Guelph, Canada
- Niels Thevs, World Agroforestry, Kyrgyzstan
- Abasse Amadou Tougiani, INRAN, Niger
- Philippe Vaast, CIRAD, Vietnam
- Meine van Noordwijk, World Agroforestry, Indonésie
- Andrea Vityi, University of Sopron, Hungary
- Michael Webb, CSIRO, Australia
- Leigh Winowiecki, World Agroforestry, Kenya
- Patrick Worms, World Agroforestry, Belgique
- Jianchu Xu, World Agroforestry, China

## COMMITTEES

## International Organising Committee

- Elisabeth Claverie de Saint Martin, CIRAD's Director General for Research and Strategy
- Jean-François Soussana, INRA's Vice President for International Policy
- Christian Dupraz, Chair of Scientific Committee, INRA, France
- Emmanuel Torquebiau, Chair of Organizing Committee CIRAD, France
- Ravi Prabhu, Representative from World Agroforestry
- Catharine Watson, World Agroforestry
- Simone Borelli, Representative from FAO
- Andrew Campbell, Representative from ACIAR
- Christophe Pinard, Representative from French Ministry of Agriculture and Food
- Barbara Baj Wójtowicz, Farmers representative, Polish EIP-AGRI Operational Group
- Zeno Piatti, Farmers representative, Gutsverwaltung Stutenhof, Austria
- Patrick Worms, EURAF President
- Badege Bishaw, President of North America Agroforestry Association (AFTA)
- Jabier Ruiz, NGO Representative, WWF European Policy Office
- Tristan Lecomte, Private Sector Representative, Pur Projet
- Judith Carmona, Representative from Occitanie Region
- Dennis Garrity, World Agroforestry / UN Convention to Combat Desertification

## Local Organising Committee

- **Emmanuel Torquebiau (chair)**, CIRAD, France
- **Sylvain Rafflegeau (co-chair)**, CIRAD, France
- Brigitte Cabantous, CIRAD, France
- Laure Corbarieu, CIRAD, France
- Nathalie Curiallet, CIRAD, France
- Christian Dupraz, INRA, France
- Marie Gosme, INRA, France
- Sandrine Renoir, CIRAD, France
- Nathalie Villemejeanne, Agropolis International, France

## Communication Group

- **Nathalie Villemejeanne (chair)**, Agropolis International,
- Frédérique Causse, CIRAD
- Chantal Dorthe, INRA
- Jeanne Finestone, World Agroforestry
- Delphine Guard, CIRAD, Graphic design
- Patrick Paris, I-Site MUSE
- Sara Quinn, CGIAR System Organization
- Christine Riou, INRA
- Lynda Robertson, CGIAR System Organization
- Emmanuel Torquebiau, CIRAD



Meet here the people behind your congress

From left to right: Nathalie Villemejeanne, Sylvain Rafflegeau, Brigitte Cabantous, Laure Corbarieu, Nathalie Curiallet, Emmanuel Torquebiau, Sandrine Renoir, Christian Dupraz, Marie Gosme

## ORGANISERS



- **CIRAD**  
Centre de coopération internationale en recherche agronomique pour le développement  
<https://www.cirad.fr>  
42 rue Scheffer  
75016 Paris - France  
Avenue Agropolis  
34398 Montpellier Cedex 5 - France



- **INRA**  
Institut National de la Recherche Agronomique  
<http://institut.inra.fr>  
147 rue de l'Université  
75007 Paris - France  
2 place Pierre Viala  
34000 Montpellier - France



- **World Agroforestry**  
<https://www.worldagroforestry.org>  
United Nations Avenue  
Nairobi 00100 - Kenya



- **Agropolis International**  
<https://www.agropolis.fr>  
1000 Avenue Agropolis  
34394 Montpellier Cedex 5 - France



- **MUSE**  
Montpellier Université d'excellence  
<https://muse.edu.umontpellier.fr>  
163 rue Auguste Broussonnet  
34090 Montpellier - France

### Carbon mapping in Portugal forest and agroforest systems using direct remote sensing and combine assign approaches

Ameray A.<sup>1</sup> (ameray.iav@gmail.com), Castro M.<sup>1</sup>, Bouhaloua M.<sup>2</sup>, Castro J.<sup>1</sup>

<sup>1</sup>Mountain Research Centre (CIMO), Polytechnic Institut of Bragança, Bragança, Portugal; <sup>2</sup>Environment and Natural Resources, IAV Institute Hassan II, Rabat, Morocco

Reducing Emissions from Deforestation and Forest Degradation (REDD and REDD+) recommend specific approaches for quantifying and spatializing ecosystem services (ES). In the context of climate change, REDD recommends the mapping of carbon stocks and its sequestration by vegetation cover to implement more appropriate environmental management practices and policies against global warming. Forest carbon mapping is a current and important environmental tool for a better land management as successful implementation of climate change mitigation (Saatchi et al., 2011). This study presents the mapping of carbon sequestration using two different approaches. Firstly, the direct Remote Sensing (DRS) approach using MODIS images (product MOD17) (Running & Zhao, 2015). Secondly, the indirect approach named Combine and Assign (CA) Approach (Goetz et al., 2009). MODIS images allow the accounting of Net Primary Productivity (NPP) which presents the quantity of carbon absorbed by vegetation cover during a period as a key indicator of ecosystem performance. The CA Approach combines remote sensing and field data in GIS environment to assess the yearly carbon sequestration for each ecozone and the carbon losses by fires in 2010, using the atmospheric flow proposed by Intergovernmental Panel on Climate Change (IPCC). Both CA and DRS mapping approaches show that the forest stands, generally, *Pinus pinaster* and *Eucalyptus* stands, in central and coastal areas have the higher CO<sub>2</sub> sequestration potential. However, these two species contribute significantly to CO<sub>2</sub> emissions comparing to all other species. The comparison between IPCC methodology and the MODIS product (MOD17) used to follow the carbon dynamic in terrestrial ecosystems has demonstrate that IPCC method can be used as a perfect method to validate MOD17 product.

**Keywords:** Climate Change, IPCC, Carbon dioxide, Geoprocessing, MODIS.

#### References:

1. Goetz et al, 2009, Carbon Balance and Management, 7 pp
2. Running & Zhao, M. ,2015, MODIS Land Team, 28pp
3. Saatchi et al, 2011, Proceedings of the National Academy of Sciences, 6pp