Dr. Galal Elawad Khaled Omer

Assistant Professor of Environmental Science and Remote Sensing, University of Khartoum, Sudan

Prof. Alkarib St. - Faculty of Forestry, University of Khartoum, Khartoum North, Postal Code 13314, , P.O. Box 32, Sudan

(gekhaled189@gmail.com; galal.elawad@uofk.edu), Tel: +249 (0)121252837

Curriculum Vitae

First name: **Galal**
Middle name: Elawad
Surname: **Omer**
Date and place of birth: April 1st ,1981, East Elgezira, Sudan
Nationality: Sudanese
Languages:Arabic (Mother tongue) and English (Second language)
Marital status: Married
Permanent address: Department of Forest Cnservation and Protection, Faculty of Forestry,University of Khartoum, Khartoum North13314, P.O.Box32, Sudan
E-mail: gekhaled189@gmail.com; galal.elawad@uofk.edu
Telephone: +249(0)121252837

➢ **Academic Qualification:**
(Qualification), (Name of Institution and location), (Major field of study),(Dates attended), (Date received).

- **Ph.D.**, University of KwaZulu-Natal, South Africa, Environmental Scienses, 2012-2016, 12/04/2017.
- **M.Sc.**, Dept. of Forest Conservation and Protection, Faculty of Forestry, University of Khartoum, Sudan, Forestry, 2007-2009, 10/11/2009.
- **B.Sc.**, 1st Class (Honours), Faculty of Forestry, University of Khartoum, Sudan, Forestry, 2000-2005, 10/10/2005.

➢ **Thesis and Dissertations:**
1. **PhD, 2017**
    - ✓ **Thesis title**: Remote Sensing of Endangered Tree Species in the Fragmented Dukuduku Indigenous Forest of KwaZulu-Natal, South Africa.
    - ✓ **Advisors**:
- ▪ **Professor Onisimo Mutanga**, School of Agricultural, Earth and Environmental Sciences, Pietermaritzburg Campus, University of KwaZulu-Natal, South Africa.
- ▪ **Dr. Elfatih M. Abdel Rahman**, Faculty of Agriculture, University of Khartoum, Khartoum North, Sudan and School of Agricultural, Earth and Environmental Sciences, Pietermaritzburg Campus, University of KwaZulu-Natal, South Africa

2. **M.Sc, 2009**

- ✓ **Thesis title**: Impact of Land Use Changes on Vegetation Cover and Sustainable Livelihoods A Long the Banks of Niles at Khartoum State, Sudan.
- ✓ **Advisor:** Dr. Babiker Ahmed El Hassan, Faculty of Forestry, University of Khartoum, Khartoum North, Sudan.

3. **B.Sc, 2005**
   - ✓ **Thesis title:** Working plan for Elfaid Om Abdalla Forest management in Kordofan State, Sudan.
   - ✓ **Advisors**: Faculty of Forestry Teaching Members

➢ **Area of Experience:**
- ✓ Environmental Sciences.
- ✓ Remote Sensing and GIS applications.
- ✓ Forest Sciences.
- ✓ Forestry.

➢ **Research Interests & Approach:**
- ✓ Environmental and forest monitoring
- ✓ Environmental and forest conservation
- ✓ Land use land cover mapping
- ✓ Vegetation remote sensing
- ✓ Environmental management
- ✓ I am applied environmentalist with research focus on mapping, predicting, and monitoring indigenous and fragmented forests.
- ✓ The research projects that I have been involved include Application of Remote Sensing and GIS in applied Environmental and Forest Sciences.
- ✓ Also, interested in classifying land use/cover types, thermal differences and relative vulnerability to climate change, assessing ecosystem fragmentation, land degradation as well as modelling forest bio-physiological variables.
- ✓ My research approach based on applied Earth Observation and Remote Sensing in forest ecoystems.

➢ **Current & proposed research projects:**
- ✓ Enhancement of Gum Arabic production under climate variability and land use transformation in semi-arid region of the gum belt of Sudan, will be funded by Commission of Scientific Research and Innovation, Ministry of Higher Education and Scientific Research, Republic of Sudan (Group Project; 2019-2022).
- ✓ Innovative Management of *Boswellia papyrifera* (Del.) Hochst Natural Stands for Enhancing Resource Productivity and Frankincense Yield in the Republic of Sudan.
- ✓ Potential utility of sentinel 2 and Landsat 8 in exploring the land use/cover changes and their impacts on forest cover in Khartoum North, Sudan (2020-2021)
- ✓ Land use/cover change evaluation and monitoring in Northern Kordofan, Sudan (2020-2021)

➢ **Work Experience:**

(Period), (Position), (Institution), (Country).

- *(10/2017 to present), (Assistant Professor), (Faculty of Forestry, University of Khartoum), (Sudan).*
- *(9/2016-8/2018), (Postdoctoral Research Fellow), (School of Agricultural, Earth and Environmental Sciences), (University of KwaZulu-Natal), (South Africa).*
- *(11/2009 – 10/2017), (Lecturer), (University of Khartoum), (Sudan).*
- *(2/2006 – 11/2009), (Teaching Assistant), (University of Khartoum), (Sudan).*
- *(2/2016-7/2016), (ENVS250 Demonstrator), (School of Agricultural, Earth and Environmental Sciences, Pietermaritzburg Campus, University of KwaZulu-Natal, South Africa).*
- *(8/2015-11/2015), (ENVS211 Demonstrator), (School of Agricultural, Earth and Environmental Sciences, Pietermaritzburg Campus, University of KwaZulu-Natal, South Africa).*
- *(2/2015-7/2016), (ENVS316 Demonstrator), (School of Agricultural, Earth and Environmental Sciences, Pietermaritzburg Campus, University of KwaZulu-Natal, South Africa).*

➢ **Awards, Grants and Fellowships:**

- ✓ August 2021: Deanship Scientific Research Prize for the best Supervsion for the Graduation Project (5th year-undegarduate students), University of Khartoum.
- ✓ August 2021: Deanship Scientific Research Prize for the best publications, University of Khartoum, (200 USD).
- ✓ **December 2019**: Deanship Scientific research Prize for the best publications, University of Khartoum, 2019 (200 USD).
- ✓ **December 2018**: Deanship Scientific research Prize for the best publications, University of Khartoum, 2018 (Grant value 10000 SDG Approx. 200 USD).
- ✓ **December 2017**: 2017 African-German Network of Excellence in Science (AGNES) Grant for Junior Researchers, 2017 (Grant value 1000 Euro).
- ✓ University of KwaZulu-Natal Scholarship (Postdoctoral Research Fellowship) for the years 2016-2018 (Grant value R15000/Montth Approx. 1000 USD)
- ✓ **April 2012**: University of KwaZulu-Natal Bursary for Ph.D. students for the years 2012-2014 (Grant value R38000/Year Approx. 3800 USD).
- ✓ **January 2012:** University of Khartoum and the Ministry of Higher Education and Scientific Research (Grant for Ph.D. study); 3 years (value 63000 USD).
- ✓ **February 2008:** Center of International Mobility (CIMO) of the Ministry for Education of Finland Grant (Grant for short courses) for three Months (Grant value 1800 Euro).
- ✓ **July 2007**: In country DAAD Scholarship (Grant for M.Sc. study) for two years (Grant value 4000 Euro).
- ✓ **June 2005:** FNC (Forests National Corporation) Prize for the Best Academic Performance in 5th year (2004 – 2005), value 500 SDG Approx. 200 USD.
- ✓ **July 2005**: University Prize for the Best Academic Performance, Department of Forest Conservation and Protection in 5th year (2004 – 2005), value 200 SDG Approx. 80 USD.

- ✓ **July 2005**: University Prize for the Best Academic Performance, Department of Forest Products and Industries in 5th year (2004 – 2005), value 200 SDG Approx. 80 USD.
- ✓ **September 2004**: University Prize for the Best Academic Performance in 4th year (2003 - 2004), value 200 SDG Approx. 80 USD.
- ✓ **September 2003:** Faculty Prize for the Second Best Academic Performance in 3rd year (2002- 2003), value 100 SDG Approx. 40 USD.
- ✓ **September 2002:** University Prize for the Best Academic Performance in 2nd year (2001- 2002), value 200 SDG Approx. 80 USD.

➢ **Teaching Activities:**
- ✓ **Courses taught**
  - ▪ **Land use**, Faculty of Forestry, University of Khartoum, **2009-2011.**
  - ▪ **Land use**, Faculty of Forestry, University of Khartoum, **2019-2020.**
  - ▪ **Land use**, Faculty of Forestry, University of Khartoum, **2020-2021**.
  - ▪ **Special Topics**, Faculty of Forestry, University of Khartoum, **2019-2020**.
  - ▪ **Special Topics**, Faculty of Forestry, University of Khartoum, **2020-2021.**
  - ▪ **Environmental Impact Assessment,** Faculty of Forestry, University of Khartoum, **2020-2021**.
  - ▪ **Environmental Issues**, Faculty of Forestry, University of Khartoum, **2020-2021**.
  - ▪ Teaching different practical courses in the Faculty of Forestry and Faculty of Agriculture for the undergraduate students (B.Sc. Degree), **2006-2009**.
  - ▪ **General Entomology** (practical course), Faculty of Forestry, University of Khartoum, **2006-2009**.
  - ▪ **Forest Entomology** (practical course), Faculty of Forestry, University of Khartoum, **2006-2009**.
  - ▪ **Forest Pathology** (practical course), Faculty of Forestry, University of Khartoum, **2006-2009**.
  - ▪ Part-time Lecturer of **Forest Entomology** at the Faculty of Agriculture - University of Khartoum (Dept. of Agriculture Protection), **2006-2009**.
  - ▪ Part-time Lecturer of **Forest Pathology** at the Faculty of Agriculture - University of Khartoum (Dept. of Agriculture Protection, **2007-2009**.

➢ **Supervision of students:**
Supervised dissertation of **one** BSc (Forestry. Honors) project, Department of Forest Conservation and Protection, Faculty of Forestry, University of Khartoum, Sudan; dissertation title: *Assessing the impacts of Land Use/Land Cover Change on Forest Development using remote sensing, Alkdi Village, Omdurman Locality, Sudan (2019-2020).*

- ➢ Supervised dissertation of **Five** BSc students (Forestry. Honors) project, Department of Forest Conservation and Protection, Faculty of Forestry, University of Khartoum, Sudan

1. **Asma Alhady Adlan Ali**, 2020. Assessing the impacts of Land Use/Land Cover Change on Forest Development using remote sensing, Alkdi Village, Omdurman Locality- Sudan.

2. **Abdelrahman Alam Elh**uda, 2021. Detecting land use/cover changes and their impact on vegetation cover using the different Landsat satellite images in Shambat and Omdurman localities, Sudan

3. **Samar M. Gumma**, 2021. Evaluation the Land Use Land/ Cover Change and their impacts on forest resources in Um Ruwaba locality, Sudan

4. **Samah Mubarak, 2022.** Impact of flooding on land use and livelihoods in Tuti Island, Khartoum state, Sudan

5. **Mohammed Jamal, 2022**. Assessment the Socioeconomic and environmental impacts of flooding in Tuti Island, Khartoum state, Sudan

➢ **Administrative Activities**:

Head: Students Cases Committee, Faculty of Forestry, University of Khartoum, Sudan (December 2020-present).
Head:COVID19 Health Services and Control Committee, Faculty of Forestry, University of Khartoum, Sudan (September 2020-present).
Deputy Dean: Faculty of Forestry, University of Khartoum, Sudan (March 2020-present).
Coordinator: Postgraduate studies (MSc and PhD candidates), Faculty of Forestry, University of Khartoum, Sudan (March 2020– present).
Head: Examiners Committee, University of Khartoum, Faculty of Forestry, University of Khartoum, Sudan (March 2020–present).
Member: University of Khartoum Senate, Sudan (March 2020–present).
Head: Self-evaluation and Quality Unit, Faculty of Forestry, University of Khartoum, Sudan (December 2019-present).
Member: Faculty Board, Faculty of Forestry, University of Khartum, Sudan (December 2019-present).
Member: Faculty Research Board, Faculty of Forestry, University of Khartoum, Sudan (December 2019-present).
Acting Head: Forest Conservation and Protection Department, Faculty of Forestry,University of Khartoum, Sudan (December 2018-January2019).
Acting Head: Forest Conservation and Protection Department, Faculty of Forestry, University of Khartoum, Sudan, February-April 2017.
Acting Head: Forest Conservation and Protection Department, Faculty of Forestry, University of Khartoum, Sudan, April-June2010.
Member: Faculty of Frestry Examiners Committee, University of Khartoum, Sudan (2007–2011).

➢ **Reviewing Services:**
I have reviewed articles for different International Journals including:
- ▪ *Remote sensing (MDPI) (Four Articles).*
- ▪ *Current Medical Imaging Review (One Article)*

- *Remote Sensing of the Environmet (One Articles).*
- *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing (One Articles).*

➢ **Professional Memberships:**
- ✓ The Sudanese Agricultural Council, Sudan, **2018**-present.
- ✓ The South African Council for Natural Scientific Professions (SACNASPS) as a Candidate Natural Scientist, South Africa, **2017**-present.
- ✓ African-German Network of Excellence in Science (AGNES), **2017**-present.
- ✓ The African Association of Remote Sensing of the Environment (AARSE), **2014**-present.
- ✓ IEEE Geoscience and Remote Sensing Society, **2014**-present.
- ✓ Sudanese Agricultural Engineers Union, Sudan, **2005**-present.
- ✓ The Agricultural Engineers Professions Union, Khartoum State, Sudan, **2005**-present.

➢ **Workshops and Training Attended:**
➢ **RedR Training course on the Project Design and Management.** A training organized by RedR UK, Sudan. Workshop held in Ewa Hotel, Khartoum (August 25 to 29, **2019**).
➢ **Training course on the Desertification and Its Control in Countries along the Silk Road Economic Belt**. A training course organized by Northwest Institute of Eco-Environment and Recourses (NIEER), Chinese Academy of Sciences (CAS), Lanzhou, China (July 11th to 31st, **2019**).
➢ **The basic course on Academic Counseling**. A training organized by Khartoum University Center for Advanced Training, Khartoum (October 29th to 31st, **2017**).
➢ **Academic Presentation Skills Development including PowerPoint Slides Preparation**, Rabie Saunders Building, University of KwaZulu-Natal, Pietermaritzburg Campus (September 12th to 13th, **2015**).
➢ **Proposal Writing and Dissertation Research and Writing/ Exactica**, Rabie Saunders Building, University of KwaZulu-Natal, Pietermaritzburg Campus (March 23th to 25th, **2015**).
➢ **Training on use of EndNote for referencing and citations, and information management**, Rabie Saunders Building, University of KwaZulu-Natal, Pietermaritzburg Campus (March 4th to 7th, **2015**).
➢ **Effective literature searching using University of KwaZulu-Natal Library electronic databases**, Rabie Saunders Building, University of KwaZulu-Natal, Pietermaritzburg Campus (March 2th to 6th, **2015**).
➢ **Pre-conference (AARSE2014) workshop and training courses in Spectrometry and Spatial Analysis**, University of Johannesburg (October 21st to 26th, **2014**).
➢ **Pre-conference (AARSE2014) workshop and training courses in Introduction to Remote Sensing for Educators and Local Authorities**, University of Johannesburg (October 21st to 24th, **2014**).
➢ **Planning and Managing your Postgraduate Degree Programme as a Project**, Chemistry outside lecture theatre, University of KwaZulu-Natal, Pietermaritzburg Campus (September 8th to 10th, **2014**).

- **Advanced Academic Writing Competence**, Rabie Saunders Building, University of KwaZulu-Natal, Pietermaritzburg Campus, (July 10th ,**2014)**.
- **MicroSoft (MS) Word Advanced**, Rabie Saunders Building, University of KwaZulu-Natal, Pietermaritzburg Campus (May 10th to 12th, **2014)**.
- **Introduction to Geographic Information Systems (ENVS211)**, Geography Department, University of KwaZulu-Natal, Pietermaritzburg Campus, 6th August to 10th November **2012.**
- **Introduction to Remote Sensing (ENVS250),** Geography Department, Univesity of KwaZulu-Natal, Pietermaritzburg Campus, (8th February to 17th June **2012)**.
- **Proposal Writing Skill, Questionnaire Design and Data Processing**.
- A workshop organised by DAAD Alumni- Khartoum in Partnerships With DAAD Office Sudan, and the Development Studies and Research Institute, University of Khartoum (August 2th to 3nd, **2009)**.
- **Agriculture and Forestry in developing countries (ME350)**, Department of Forest Ecology, University of Helsinki, Finland (February 1st –April 30th **2008**).
- **Tropical Forest Ecology and Silviculture (ME351)**, Department of Forest Ecology, University of Helsinki, Finland (February 1st –April 30th **2008**).
- **Seminar on Agriculture and Forestry in developing countries (ME450),** Department of Forest Ecology, University of Helsinki, Finland (February 1st – April 30th **2008**).
- **Agroforestry in tropical and developing countries (ME454)**, Department of Forest Ecology, University of Helsinki, Finland (February 1st –April 30th **2008**).
- **Reseach seminar: Tropical silviculture (ME456)**, Department of Forest Ecology, University of Helsinki, Finland (February 1st –April 30th **2008**).
- **English language for communication Level (3),** University of Khartoum, Faculty of Art, Department of English (13th September – 18th October **2007)**.
- **An Introduction to theory and measurement of tree Ecophysiology**, Faculty of Forestry, University of Khartoum (June 5th -16th **2007)**.
- **English language for communication Level one,** University of Khartoum, Faculty of Art, Department of English (January- March **2007**).
- **Intermediate Level**, University of Khartoum, Faculty of Art, Department of English (August- October 2006).
- **Curriculum Development of Faculty of Forestry**, University of Khartoum organized by Faculty of Forestry Staff and Participation of Stakeholders (April to October **2006)**.
- **Agroforestry for dryland rehabilitation and development,** Faculty of Forestry, University of Khartoum (20th August - 19th September **2006).**
- **Growth and yield models and their uses, Forest management decision support tools**, Faculty of Forestry, University of Khartoum (July 22th - 27th **2006)**.
- **Statistical methods with special emphasis on its applications to forestry** from 15th -22th July **2006**.
- **Successfully completed the initial course in EDUCATIONAL PREPARATION** Organized at the Staff Development Centre, University of Khartoum (3rd June to 6th July **2006).**
- **Pre- intermediate Level**, University of Khartoum, Faculty of Art, Department of English (May- July **2006).**

- ➤ **English language for Elementary level**, University of Khartoum, Faculty of Art, Department of English (February **2006).**

- ➤ <u>**Conferences and invited talks:**</u>

1. Omer, G., Mutanga, O., Abdel-Rahman, E.M., Adam, E. (15th -18th August 2018). **Mapping threatened tree species using WorldView-2 data and advanced machines learning classification algorithms, KwaZulu–Natal, South Africa**. The 2nd Annual International Conference of the Regional Centre for Mapping of Resources for Development (RCMRD), Nairobi, Kenya. (*Oral*).

2. Omer, G., Mutanga, O., Abdel-Rahman, E.M., Peerbhay, K., Adam, E. (27th - 29th September 2017). **Mapping leaf nitrogen and carbon concentrations of intact and fragmented indigenous forest ecosystems using empirical modeling techniques and WorldView-2 data, KwaZulu–Natal, South Africa**. The 1st Annual International Conference of the Regional Centre for Mapping of Resources for Development (RCMRD), Nairobi, Kenya. (*Oral*).

3. Omer, G., Mutanga, O., Abdel-Rahman, E.M., Adam, E. (28th - 31st October 2014). **Potential utility of the WorldView-2 multispectral data and support vector machines algorithm to classifying land use/cover in Dukuduku landscape, Kwazulu-Natal, South Africa.** The 10th conference of African Association of Remote Sensing of the Environment conference (AARSE), Jouhanesburg, South Africa. (*Oral*).

4. Omer, G., Elhassan, B.A. (27th Feb to 2nd May 2010). **Impact of land use changes on vegetation cover and sustainable livelihoods along the Banks of Niles at Khartoum State**. International Conference on Graduate studies and Scientific Research Conference, University of Khartoum, Friendship Hall, Khartoum, Sudan. (*Oral*).

- ➤ **Publications:**

1. Gadallah, N. A. H., Hanoo, A. I. A., Diab, E and **Omer G. 2021.** Characterizing conservative and protective needs of the aridland forests of Sudan, *Journal of Forestry Research. pp. 1-9.*

2. **Omer, G. E. K. 2019**. Remote Sensing of Endangered Tree Species in the Fragmented Dukuduku Indigenous Forest of KwaZulu-Natal, South Africa. University of KwaZulu-Natal, Pietermaritzburg. pp. 318. *https://books.google.com/books?id=r9wDugEACAJ.*

3. Timothy, D., Mutanga, O. and **Omer G. 2019**. Assessing edge effect on the spatial distribution of selected forest biochemical properties derived using Worldview data in Dukuduku forests, South Africa, *African Journal of Ecolog* Vol. 00, pp. 1– 13. *https://doi.org/10.1111/aje.12604.*

4. **Omer, G. E. K. 2019**. Remote Sensing of Endangered Tree Species in the Fragmented Dukuduku Indigenous Forest of KwaZulu-Natal, South Africa, University of KwaZulu-Natal, Pietermaritzburg, *Doctoral Dissertations. July 2016. ukzn-dspace.ukzn.ac.za. pp 181.*

5. Mutanga, O., Timothy D. and **Omer G. 2017**. Remote sensing of crop health for food security in Africa: Potentials and constraints, *Remote Sensing Applications: Society and Environment Vol. 8, pp. 231–239.*

6. **Omer, G.,** Mutanga, O., Abdel-Rahman, E.M., Peerbhay, K., Adam, E. **2017**. Mapping leaf nitrogen and carbon concentrations of intact and fragmented indigenous forest

ecosystems using empirical modeling techniques and WorldView-2 data. *ISPRS Journal of Photogrammetry and Remote Sensing Vol. 131, pp. 26-39.*

7. **Omer G.,** Mutanga, O., Abdel-Rahman, E.M. and Adam, E. **2016**. Empirical Prediction of Leaf Area Index (LAI) of Endangered Tree Species in Intact and Fragmented Indigenous Forests Ecosystems Using WorldView-2 Data and Two Robust Machine Learning Algorithms, *remote sensing Vol. 8, pp. 1-26.*

8. **Omer, G.,** Mutanga, O., Abdel-Rahman, E.M. and Adam, E. **2015**. Performance of support vector machines and artificial neural network for mapping endangered tree species using WorldView-2 data in Dukuduku forest, South Africa. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing Vol. 8, pp. 4825-4840.*

9. **Omer, G.,** Mutanga, O., Abdel-Rahman, E.M. and Adam , E. **2015**. Exploring the utility of the additional WorldView-2 bands and support vector machines in mapping land use/land cover in a fragmented ecosystem, South Africa. *South African Journal of geomatics Vol. 4, pp. 414-133.*

10. **Omer, G**., Elhassan, B.A. and Mohammed, F.A. 2015. Assessing the Impact of Different Land Use Activities on the Vegetation Cover and Sustainable Livelihoods along the Banks of Niles at Khartoum State, Sudan. *Journal of Geoscience and Environment Protection Vol. 3, pp. 52-61.*

11. Omer, G., Mutanga, O., Abdel-Rahman, E.M. and Adam, E. 2014. Potential utility of the WorldView-2 multispectral data and support vector machines algorithm to classifying land use/cover in Dukuduku landscape, Kwazulu-Natal, South Africa, *The 10th conference of the African Association of Remote Sensing of the Environment (AARSE), Johannesburg, South Africa, pp. 309-318.*

> ## Publications submitted or in preparation (*approximate or actual submission dates*):

1. **Omer G.,** Mutanga, O., and Timothy D. *In Review*. Assessing the impacts of land use activities and forest fragmentation on the forest species characteristics and structure in Dukuduku forest area, KwaZulu-Natal, South Africa. *South African Journal of Science*.

2. **Omer G**., and Mutanga, O. *In Prep*. A review of remote sensing techniques in mapping Endangered Tree Species in Dukuduku indigenous forest, KwaZulu-Natal, South Africa.

3. *Omer G, Asma Adlan. In Prep. Assessing the impacts of Land Use/Land Cover Change on Forest Development using remote sensing, Alkdi Village, Omdurman Locality, Sudan.*

> ## References:

1. **Prof. Onisimo Mutanga**, School of Agricultural, Earth and Environmental Sciences. Geography department, University of KwaZulu-Natal, South Africa, Email: mutangao@ukzn.ac.za.

2. **Dr. Elfatih M. Abdel-Rahman**, School of Agricultural, Eearth and Environmental Sciences. Geography department, University of KwaZulu-Natal, South Africa, Email: elfatihabdelrahman@gmail.com.

3. **Prof. Jens Gebauer**, Professor of Sustainable Agricultural Production Systems with special focus on Horticulture and Humboldt-Representative, Rhine-Waal University of

Applied Sciences, D-47533 Kleve, Germany, Email: jens.gebauer@hochschule-rhein-waal.de.

4. **Dr. Timothy Dube**, Institute for Water Studies, Deptment of Earth Sciences, University of the Western Cape, Private Bag X17, Bellville, 7535, South Africa, Email: tidube@uwc.ac.za.