

Dr Bruce Lankford. Water and Irrigation Scientist.

Key Qualifications

- Water management specialist covering irrigation, hydrology, water resources planning, river basin management, sustainable development, catchment resilience, agriculture and soils; mainly in a Sub-Saharan context.
- Specialized in rehabilitation and improvement of irrigation systems; including technical investigations, extension, water user associations, participatory research and implementation of improvement programmes.
- Long-term and international expertise in irrigation efficiency and productivity including many publications.
- Use of the river basin game and Excel models in water sharing workshops with resource users and decision-makers; has also involved training of trainers in the use of the game.
- Capability in analysis and reviews of water policy at local, regional and international levels.
- Experience of capacity-building (including strengthening water user associations), assessing training needs, curriculum development, and developing/giving training courses with lectures, workshops and seminar sessions.
- Experienced in assessment of hydrology, agro-meteorology, and impact of irrigation development on water resources and hydrological environment.
- Analysis of river basin and catchment water sectoral demands and allocation for example, domestic/health sectors, water quality, and ecological/environmental demands of water.
- Research experience includes both research management (including budget and staff supervision and monitoring) and research design (e.g. establishing pilot surveys and identifying key researchable issues).
- Project management and administration skills: planning and budgeting; chairing of committees; reporting, writing and reviews of proposals and bids; marketing; interviewing; co-ordinating; and development and monitoring of prioritised strategies and action plans.
- Communication, team-working, management and facilitation skills. Organised/presented many talks/seminars/conferences.
- Work experience covers 37 years, 14 years internationally, includes short-term consultancies, research, research management and long-term TA projects.
- Country experience: Swaziland/Eswatini, Tanzania, India, Kyrgyzstan, Pakistan, Malaysia, Mozambique, Sudan, Ethiopia, Nigeria, Kenya, South Africa, Zambia, Laos, China, Rwanda, Botswana, Belize, Israel/Palestine, UK
- Worked with: CDC, DFID, IWMI, ODI, WWF, IUCN, INR (S Africa), FAO, SADC, Adam Smith International, DAI, MCC (Washington DC), WaterAid, GIZ, Winrock Int, Cranfield University, Kings College London.

Education

PhD. Irrigation Design & Management, University of Newcastle upon Tyne, UK, 1998.

M.Sc. Irrigation (Distinction), University of Newcastle upon Tyne, UK, 1992.

B.Sc. Hons. (2:1) Soil Science, University of Reading, UK, 1985.

Further Training

Water Evaluation and Planning (WEAP) software for River Basin Management, Tellus Institute, Boston, USA, 2002.

Finance for Non-Financial Managers, Mananga Agricultural Management College, Swaziland, 1988.

Mid-Management 1, Maccuvlei Institute, Swaziland, 1987.

On-going/past memberships and trustee positions

Chair of Irrigation Commission on Irrigation and Drainage (ICID) - British Section 2010-2013.

Past trustee positions for WaterWitness International and for the Jack Wright Memorial Trust.

Editorial member on journals: Water Security; Waterlines; Water Alternatives; Agricultural Water Management; Irrigation & Drainage.

EMPLOYMENT SUMMARY

2019 – ongoing	Emeritus Professor at UEA and freelance consultant in water and irrigation policy
2011 - 2019	Professor of Water and Irrigation Policy, School of International Development, UEA, UK
2006 - 2010	Head of School, School of International Development, UEA, UK
2005 - 2011	Senior Lecturer in Natural Resources, School of International Development, UEA, UK
1994 - 2005	Lecturer in Natural Resources, School of Development Studies, UEA, UK
1990 - 1994	Consultant & Irrigation Agronomist, Hunting Technical Services Ltd, UK
1985 - 1989	Irrigation Agronomist, Commonwealth Development Corporation, Swaziland
1983 - 1984	Assistant Soils Agronomist, Commonwealth Development Corporation (CDC), Swaziland

Professional record

Feb 2021, **UK**, Consultancy/report writer for WaterAid. “A rapid review of literature covering the impacts of ‘big water’ users on WASH”

Dec 2020, **UK**, Consultancy/report writer for WaterAid. “WaterAid Primer on WASH and Resilience”

Oct 2020, **UK**. Adviser for Winrock, USA. Assisted the design and testing of the ECO Water Security Game

Nov 2019, **UK**, Water Security training for WaterAid London. Alongside two WaterAid staff, provided training to WaterAid on water security, climate change and water governance.

Aug 2019, **UK**, MCC, USA. Irrigation adviser for Millennium Challenge Corporation (MCC) regarding irrigation monitoring and evaluation for MCC’s existing and forthcoming irrigation investments.

Various 2019. **UK**, GIZ. Peer reviewer for GIZ, ODI and IUCN. Advisory work on best practice for reviewing irrigation interventions at Kinyara Sugar, part funded by GIZ, as part of the International Water Stewardship Programme (IWaSP) in Uganda.

July 2019, **UK**, Reviewer, ABSugar. Reviewed proposals for funding ABS work on irrigation efficiency.

Feb-Apr 2019. **UK/Tanzania/USA**, DFID. Author, Overseas Development Institute (ODI). Short-term advisory leading to this synthesis report: “Farmer-led irrigation in sub-Saharan Africa. A synthesis of current understandings. Steve Wiggins & Bruce Lankford”. Also presented work at a workshop in Tanzania and at the Water for Food Conference, Lincoln Nebraska, 2019.

Mar 2019, **UK**. Advice on climate-change adaptation for irrigation; guidelines for the ADB, sub-contracted.

Jan 2019, **Netherlands**, Peer reviewer for QANU. To assess NVAO standards (Dutch Flemish Accreditation Organisation) for the BSc and MSc degrees in Land and Water, Wageningen University.

Sep 2018, **Rwanda**, GoR. Consultant/Adam Smith International. Helped Agri-TAF to develop terms of references for the Ndego Irrigation project. Reviewed the proposed Rwanda Irrigation Master Plan.

May-Aug 2018, **Rwanda**, DFID, Consultant/Adam Smith International. Part of the Agri-TAF ‘Due Diligence’ team funded by DFID to examine the proposed large-scale drip irrigation Gabiro Commercial Farms Project for the Govt of Rwanda.

Nov 2016 to Sep 2019, **South Africa**, BBSRC, Researcher. ‘Increasing resilience to water-related risk in the UK fresh fruit & vegetable system’. Co-Principal Investigator examining the resilience of irrigation systems in the Groot Letaba Catchment, South Africa; with Cranfield University and Institute of Natural Resources (INR), South Africa.

Dec 2017 to Mar 2018, **UK/Italy**, FAO. Consultant/Coordinator. FAO White Paper on Water Accounting. Chaired a meeting in Rome and coordinated the FAO WP on water accounting in time for presentation by FAO to the World Water Forum meeting in Brasilia 2018.

May 1994 to Oct 2019, **UK**, Professor of Water and Irrigation Policy (Aug 2011-2019). Head of School (Aug 2006-Aug 2010). Researcher/Senior Lecturer in Natural Resources. School of International Development, University of East Anglia, UK. Major responsibility for School staff (>35) administration, budgets and strategies for a range of teaching and research activities and programmes to grow the School’s size taking it to a higher level of profitability by 2010. High level of responsibility for delivering the RAE (Research Assessment Exercise) and managing staff appointments. Liaised with Faculty and University committees and senior staff on many related issues. Identified opportunities with other Schools in the University. Director of BSc and MSc programmes; Chair of Computing and Equipment Committee; Study Skills; Overseas Development Group Director; Co-Director of the UEA Water Security Research Centre. Responsible for developing and teaching >10 BSc and MSc courses on water security, hydrology, agro-meteorology, irrigation and water resources assessment, planning and management. Lectured on: hydrology (rainfall assessment, evaporation, surface water flow, catchment processes, groundwater, measurement and evaluation, hydrological modelling, links with irrigation); supply and demand management; institutions; participatory methods; village water supply; environmental demands for water; integrated water management, global irrigation issues; and policies regarding the management of the water sector. Contributed to courses on natural resource management and theory. Taught courses on soils, statistics, modelling and research methods. Provided training courses for visiting professionals. Had major responsibility for selected administrative matters and budgets within the

School. Supervision of PhD students on projects covering river basin management, water policy, irrigation management and water and development. External Examiner 2003-2006 for University of Newcastle upon Tyne on three Masters programmes: External examiner 2009-2012 & 2015 Cranfield University. Reviewer for >30 journals. External reviewer for; Academy of Finland; IFS (Sweden); VLIR-UOS (Belgium); DOC Fellowship of the Austrian Academy of Sciences; NWO-Programma Water (Netherlands); The London International Development Centre. Shortlisted for 'Most Innovative Teacher' Award, UEA/SU 2016.

2000-2013, **UK**, Water Policy Analyst for various studies: 1) OASIS (the DFID Advisory Group) commenting on "CSD Synthesis Paper on Water" for the UN Commission on Sustainable Development (CSD) Apr 2004; 2) UK White Paper on Agriculture, mid-2002; 3) Drawing up a framework for evaluation of EU water projects, Dec 03; 4) Contributor to World Bank E-conference on smallholder irrigation in Sub-Saharan Africa March 03; 5) Input to water management strategy for PRSP in Tanzania via WaterAid; 6) Commentary on the Tanzanian Water Resources Strategy directly for the steering committee; 7) Part of WWF's Virtual Water Steering Panel including meetings designed to consider the virtual water concept for WWF policy; 8) Contributed to IIED's co-ordination of DFID's emerging water policy; 9) Lead panellist for DFID's policy on irrigation in Africa, following on from authorship of the Commission for Africa Irrigation analysis with two meetings in Nov 2006 and Mar 2007; 10) Expert invitee for the Royal Society Study into Biological Approaches to Food Production in the next twenty years. 11) Contribution to Food Security study commissioned by UK Chief Scientist, J. Beddington 2010; 12) Contribution to Food Security analysis for UKWRIP Agriculture Action Group 2013.

Apr, May 2017 **UK**, USAID, Reviewer for Winrock. "International Water Security Toolkits", under the 'Sustainable Water Partnership LWA'.

Feb 2017, **Israel/Palestine**, CNRS, Researcher. Contributing to research on the commons of wastes and wastages in irrigated agriculture in the West Bank. Research led by Dr Julie Trottier funded by French research body CNRS.

2016, **UK/Sri Lanka**, IWMI, Researcher/author. With group of IWMI researchers, wrote a journal article on large scale irrigation. Attended an IWMI workshop in Sri Lanka on same topic.

Jan 2016-18, **UK**, IUCN/WWF. Researcher/author. Contributing to a policy brief on policy pathways for efficiency irrigation leading to sessions at World Water Week 2017 and 2018.

Nov 2013, **South Africa**, Belmont Funding, Advisor. Role-playing games as part of a team researching the use and uptake of climate forecasting for improved water and land management in Southern Africa.

Oct 2013, Jun 2014, **Belize**, FAO, Irrigation specialist (Hydrology/GIS/irrigation). Part of a multidisciplinary team of consultants recruited by FAO to undertake a mission to formulate an irrigation and drainage strategy for the Government of Belize including on public-private partnership policies.

May-Jul 2013, **UK**, IWMI, Irrigation policy analyst (desk study). Commissioned by the International Water Management Institute to formulate research frameworks for the Water Land Environment (WLE) programme of the CGIAR network to process concept notes on irrigation in Sub-Saharan Africa.

August 2012, **Botswana**, SIWI, Session Leader. Water allocation and water efficiency. River Basin Game and Water Management Discussions. Utilised the River Basin Game and models to explore theory for water allocation and water use efficiency for staff from the Botswana Department for Water Affairs.

Oct 2011, **Botswana**, SADC/GIZ, Session Leader. River Basin Game and Water Management Discussions. Utilised the River Basin Game and models to explore theory for re-allocation of water in the Limpopo Basin for LIMCOM.

Oct 2010, **Abu Dhabi**, AWA, Session Leader for Arab Water Academy. River Basin Game and Water Management Discussions. Utilised the River Basin Game and models to explore theory for re-allocation of water. Trained 25 professionals from the Middle East region.

Aug 2010, **Sweden**, Ramboll & SIWI. Session Leader. River Basin Game and Water Management Discussions. Utilised the River Basin Game and models to explore theory for re-allocation of water in the Zambezi Basin.

Various 2008-2010, **South Africa**, NERC, Co-Principal Investigator. The impacts of ecosystem services and environmental governance on human well-being in the Pongola region, South Africa. Research to characterise and assess the impact of management decisions on the state of ecosystem services and associated human wellbeing in the Pongola floodplain system in S Africa.

May 2008, **China**, UEA. A short visit to discuss collaboration with China Agricultural University, Chinese Centre for Agricultural Policy, WWF-China and DFID.

Nov 2007/8, **Laos**, IWMI/ Ramboll/WATERNET. Session Leader. River Basin Game and Water Management Discussions. Utilised the River Basin Game and models to explore theory for re-allocation of water. Trained 28 professionals from countries around the world, including some from the Mekong Basin.

Various 08/09, **Rwanda**, IWMI/Ramboll/WATERNET, Session Leader. River Basin Game and Water Management Discussions. Utilised the River Basin Game and models to explore theory for re-allocation of water. Trained 30 professionals from countries around the world, including some from the Nile Basin.

Various 2007/08/9/10, **Zambia/Malawi/Botswana**, SADC/IWMI/Ramboll/WATERNET, Session Leader. River Basin Game and Water Management Discussions with SADC. Utilised the River Basin Game to explore re-allocation options for high level decision-makers in the Zambezi Basin in Zambia, Malawi and Botswana. In 2008, developed a decision-aid to explore how the SADC and Helsinki Protocols might be used to determine equitable allocation according to a set of principles.

Nov 2005/6, **South Africa**, IWMI/Ramboll, Session Leader. Integrated Water Resource Management, Advanced International Training Program. On a training program organized by the International Water Management Institute and Ramboll Consultants, led a session on the relationship between decision-aids and river basin management. Took part in a study tour of the Oliphants River Basin. Repeated in 2006.

Mar 2006, **South Africa**, IWMI. Workshop Facilitator, River Basin Game and Conflict Dialogue. Conducted two workshops around the River Basin Game, one with Southern African scientists including IWMI, followed by one with local water users in the Oliphants River Basin.

June 2001-06, **Tanzania**, DFID with IWMI, Project Team Leader. Raising Irrigation Productivity and Releasing Water for Intersectoral Needs (RIPARWIN). Responsible for directing a major DFID-funded 5-year research project on irrigation and river basin management. Involving over 15 researchers, this aimed to inform stakeholders and decision-makers within the Ruaha River Basin about policy options for re-allocating water and increasing irrigation productivity. Worked closely with research partners - the Soil Water Management Research Group (SWMRG) & the International Water Management Institute (IWMI) in coordinating various research programmes on institutional analysis, livelihood and economic values of water, wetlands values & functions, smallholder irrigation, and community management of water for multi-purpose use. Organised/attended numerous meetings, including the East African River Basin Management Conference and workshops that centred on the River Basin Game, a conflict-resolution tool and simulation model of water competition and resolution, plus RUBDA a computer decision-aid. Reviewed and edited submissions from researchers, and drew up new research lines of inquiry. Co-wrote Policy Briefs and information sheets. Managed logistics, budgets and log-frame outputs, and the use of video-media to influence farmers' understanding of water management.

Sep 2005, **Kenya**, Workshop Participant and Presenter. "The River Basin Game: A role-playing board game for initiating discussions on visions and strategies of water allocation". In *Managing Water Conflicts: Emerging Challenges and Opportunities*". NETWAS - 17th Regional Water And Sanitation Seminar, 5-9th September 2005, Mombasa, Kenya.

May-June 2005, **Nigeria**, DFID, River Basin Workshop Facilitator. On the Joint Wetlands Project (JWL) responsible for designing and conducting two workshops for stakeholders in the Hadejia Jama'are Komadugu Yobe Basin for the DFID-funded "JWL" project in Northern Nigeria. The workshops were designed around the use of the River Basin Game, devised by Lankford to facilitate the discussion of water sharing arrangements in a river basin context.

Nov 2004, **UK**, DFID, Irrigation and Water Development Analyst. For the Commission for Africa, formulated a comprehensive framework for irrigation and water development. Reviewed opportunities to increase the productive potential of arable land by increasing the area of irrigation, increasing access by poor people to irrigation and/or the benefits of irrigation, and by enhancing the management of existing areas under irrigation. Determined sustainable targets for growth and productivity gains, a budget and a benefit: cost analysis.

Apr 2003 to Mid 2004, **Tanzania, Ethiopia**, IWMI – CA, Researcher/Adviser. Productivity of Water and Interacting Systems (PWAIS). Contributed to this research project funded and commissioned by the Global Comprehensive Assessment (International Water Management Institute) designed to examine the measurement of productivity of water in irrigated and rainfed agriculture in the Southern Highlands of Tanzania and Tigray Region of Ethiopia. Contributed to opening workshops in both countries and helped draw up a research programme using a log-frame methodology.

Jul 2003, **UK**, ODG/IDS, 'Rural Livelihoods', Overseas Development Group. 'Pastoralism: Productivity, Governance and Services' Institute of Development Studies. Presented sessions on two short-courses on rural livelihoods with an emphasis on policy directions to promote the adoption and expansion of smallholder irrigation in Sub-Saharan Africa, while recognizing the institutional and livelihood challenges in irrigation within a river basin context.

Oct 2002, May/June 2003, **Kyrgyzstan**, DFID. International Irrigation Specialist. On the Sustainable Livelihoods For Livestock Producing Communities (SLLPC) project, analysed infrastructure and WUA institutions for managing irrigation water in order to recommend investments and support by the DFID project to enhance agriculture-based livelihoods in villages in Manas Region. The review indicated a good level of institutional sustainability and technical ability of the newly formed WUA (following the hand-over of irrigation systems to farmers). Designed small infrastructural works and proposed conditions that leveraged new water management capabilities. During the 2nd input, assisted in delivering and chairing a two-day seminar involving 42 WUAs in collaboration with the World Bank On-Farm Irrigation Project, and visited three WUA in Chui Region to assess other project proposals.

Apr 2003, **UK**, Iteco. Consultant. Hanang Wheat Farms for Iteco Consulting. Desk study on recommendations, risks and information needs for implementation of supplementary irrigation for 41 000 ha wheat farm in Northern Tanzania.

Various 2002-05, **India**, World Bank, Irrigation Specialist. Second Chennai Water Supply Project: Reassessment Of Groundwater Potential in the A-K Basin. In three inputs, responsible for investigations of irrigation management to determine means and outcomes of transfer of water rights from agriculture to meet urban water needs for the city of Chennai (Madras). Determined quantities of water being utilized by irrigated agriculture from groundwater and assisted in discussions related to modeling borehole/aquifer management. Reviewed previous estimations of water demand. Interviewed farmers and examined current purchasing of water from farmers by Metro Water.

Aug 2001, **UK**, Organiser: Irrigation Design Management Seminar. ODG Visiting Professional contribution for the project 'Improving Livelihoods in Northern Bihar and Eastern Uttar Pradesh'.

Jun 2000, Feb 2001, May 2001, **Tanzania**, DFID, Researcher. On the Livelihoods and Diversification Directions Explored by Research project, (LADDER), planned, organised and undertook research to examine irrigation-based rural livelihood issues in relation to the policy environment in Tanzania. Visited various research and donor organisations in Dar Es Salaam to establish collaborative working arrangements and likely routes for promotional pathways. Worked as a collaborative researcher as a part of this 10-person inter-disciplinary team.

1999-2000, **Tanzania**, DFID. Principal Researcher on Irrigation Efficiency Research. In collaboration with the Soil Water Management Research Group (SWMRG) at the Sokoine University of Agriculture (SUA), planned and conducted research studies to assess the efficiency of the various types of formal and informal rice irrigation systems on the Usangu Plains within the context of river basin management. Supervised a PhD student conducting the fieldwork. Drew up the budget for this research and monitored costs accordingly.

Various 1999-2000, **Tanzania**, DFID. Water Management Specialist, Sustainable Management of the Usangu Wetlands and Catchments (SMUWC). Worked as a consultant with HTS on this process-orientated river basin/catchment project with inter-sectoral allocation objectives (between rice irrigation, HEP, wetlands, a national park and upper-catchment farmers). Completed inputs to determine the impact of irrigation activities on the wetlands and hydrology of the Usangu Catchment. Worked with farmers to understand their management of water. Formulated models to determine effects of climate and river flows on area irrigated and efficiency of irrigation systems. Worked alongside national and international experts, contributing to discussions regarding water and irrigation policies and capacity-building at local, river-basin and national levels. Developed policies toward integrating water supply for cross-sectoral use and re-allocation including the "red routes" strategy of prioritising compensation flows. Drafted a position paper for discussion on a flexible water strategies for the area, including proportional water rights.

Various 1999, **Mozambique**, British Council, Natural Resources Adviser. With the Catholic University of Mozambique (UCM), provided advice on curriculum development and planning as a part of the proposed establishment of a new Faculty of Agriculture of UCM. Identified training and skills needs reflecting local and national natural resources management. Facilitated a workshop designing curricula and student-learning progress.

Oct 1998, **UK**, Expert Opinion. "Sugarcane Business Interruption Claim" for Barlow Lyde & Gilbert, London, Undertook a desk study following failure of irrigation for a project based in Sudan.

Sept 1997, **UK**, Organiser. Irrigation and Water Management Seminar, CAP 21 Course, UEA, Developed and presented a seminar for participants on: Capacity 21: Capacity Building for Introducing Environmental Economics into Decision Making for Sustainable Development.

June 1997, **Swaziland**, SSA. Short course on water management. Swaziland Sugar Association (SSA). Developed and presented a two-day course to managers on improved water management. The course, entitled "Self-Running Irrigation Schemes" used spreadsheets, discussion exercises and a field trip.

Feb-Jun 1997, Jun-Jul 1996, Jul-Aug 1995, **Swaziland**, PhD Research, Mhlume Sugar Company, Royal Swaziland Sugar Company, Ubombo Ranches, Vuvulane Irrigated Farmers. Conducted research for PhD on design-management interactions for high performance irrigation scheduling on lowveld irrigation schemes. Undertook participatory research with farmers and estate employees on irrigation operation of water delivery schedules. Developed methods for improving water operation to fit with existing control technologies and cropping plans. Determined methods for upgrading canal equipment to fit with intended water schedules.

1995-99, **UK**, Sugarcane and Irrigation Consultant. For ED&F Man Sugar Ltd, conducted seven desk studies on sugarcane irrigation agronomy, and soils and irrigation.

Aug 1994, **UK**, Irrigation Consultant for Bob Zepecki Associates, USA on date palm water requirements.

Sep 1990 to Mar 1994, **UK**, Consultant (Irrigation Agronomist) and Administration Assistant. Employed by Hunting Technical Services Limited (HTS). When not on assignment, wrote proposals.

Jan-Feb 1994, April-May 1993, Oct-Nov 1993. **Sudan**, UNDP Soils and Irrigation Agronomist (HTS), Lower Atbara Area Development Scheme (ADSLA). Studied irrigated agriculture, soil types and crop water use. With farmers, researched constraints to efficient use and management of groundwater. Reviewed operation of farmer groups for community management of water. Examined farm inputs and labour requirements and determined gross margins. Investigated existing range of crops (wheat, vegetables, sorghum) and the introduction of alternative crops likely to yield a higher return (oilseeds and additional vegetables). Assessed the need for further studies in soil survey, land use and on-farm water management. For the latter, planned an appropriate adaptive research programme.

May-August 1992, **Malaysia**. Researcher (HTS), MSc Irrigation Degree. Followed a programme of study in England/Malaysia covering: hydrology; soils; design; engineering; farming systems; water economics; land drainage; irrigation science, principles, systems and management. In Malaysia, carried out research and made detailed field studies of sprinkler and drip irrigation systems. Was seconded for 6 weeks to the Department of Irrigation and Drainage to research a dissertation; 'A Systems Approach to Water Control at the Sungai Muda Irrigation Scheme', examining aspects of management that were influencing performance.

Jan to Sept 1991, **UK**. With HTS, completed the Agriculture Studies volume for the Right Bank Master Plan. Carried out general administrative duties, statistical work and reviewed crop water use for an ODA project in Sindh Province, Pakistan.

Oct-Dec 1990, **Pakistan**, DFID. Irrigation Agronomist (HTS). Lower Indus Region, Study for Right Bank Master Plan (RBMP). As a member of a multi-disciplinary team, undertook a study of agricultural production in Right Bank Indus Irrigated Area. Evaluated factors influencing cropping patterns and the production of individual crops, notably rice and wheat. Assessed the influence of the 1.6 million ha irrigation system on the distribution of agriculture types. Studied husbandry practices (fertilisers, crop protection), water supply, soils, on-farm water management, post-harvest handling and processing. Gave particular attention to evaluation of the effects of flooding and salinity on rice yields and salinity and dry soil conditions on wheat yields. Examined crop diversification plans for non-rice crops including sugarcane, oilseeds, cotton and vegetables. Identified major constraints to agricultural production and assessed institutional support services (research, extension, seeds and fertilisers supply services and marketing channels). Participated in the formulation of plans for the improvement of irrigated agricultural production of the Right Bank.

Oct 1988, **Zimbabwe**, Study Tour (CDC). Studied Lowveld Sugarcane Industry with reference to irrigation & harvesting methods.

Nov 1988, **Mauritius**, Study Tour (CDC). Studied sprinkler, furrow and drip irrigation methods on sugarcane estates throughout the island. Attended a sugarcane irrigation symposium.

Sep 85 - Sept 89, **Swaziland** CDC, Irrigation Agronomist. Inyoni Yami Swaziland Irrigation Scheme (IYSIS). As a staff member of Commonwealth Development Corporation (CDC), had major responsibility in review and rehabilitation of irrigation management on a 10,000 ha sugarcane estate by various approaches. Identified yield losses due to irrigation and soil management practices. Implemented changes to irrigation scheduling, data collection, computer records, canal control systems and field water supply. Irrigation improvements were achieved through the training of field irrigation staff. Investigated meteorological records, soil-water-sugarcane growth and yield

relationships including studies of root distribution and soil structure. Planned and implemented a programme of irrigation field trials designed to investigate efficient use of water. Advised on the management of drip and sprinkler irrigation systems for both sugarcane and citrus crops. Reviewed water delivery and control in canal systems, including the use of small storage dams, and made engineering recommendations. Identified in-field and field-edge water management deficiencies. Recommended 'most-appropriate' methods of irrigating problematic sodic soils with water of a low salt content. Designed/implemented performance measurement for attaining irrigation targets. This work led to the amendment of existing irrigation and cultivation practices, resulting in improvements in crop yield, water use efficiency and long-term maintenance of favourable soil tilth. Assessed soils and land capability for expansion of sugarcane, citrus and cotton crops.

Sep-Aug 1984, **Swaziland**, CDC, Soils Agronomist, Inyoni Yami Swaziland Irrigation Scheme (IYSIS). Responsible for soil and land surveys in cultivated and bushland areas to determine soil types, monitor salinity levels under irrigation and identify further suitable areas for sugarcane production. Assisted in sugarcane agronomy and trials covering studies of crop growth in relation to soil types, soil salinity and differing cultivation practices.

Jan 1982, **Guyana**. On assignment to study soils, sugarcane cultivation and harvesting methods during BSc degree.

Skills/Other

Languages: English (Mother tongue), Spanish (Fair), French (Fair), siSwati (Basic).

Computer Literacy: MS Office. WordPress. Statistics: SPSS. WEAP Basin Planning.

Vehicle repair and restoration.

Publications

1. Lankford, B; McCosh, J; Pringle, C., Shabalala, M; Hess, T. and Knox, J. (in prep.) Water, efficiency, resilience, drought (WERD); a framework to understand robustness to drought in irrigated catchments.
2. Lankford, B. A. 2021. The atmospheric carbon commons in transition; from a 'sink commons' to a 'husbandry commons' to an 'emergency paracommons' (for permanently salvaging carbon dioxide to reach 350 ppm). Chapter in 'Negotiating Climate Change in Crisis' (Eds Sullivan, S and Boehm, S). Forthcoming.
3. Geere J-A, Hunter, P and Lankford, B. (2021). WaSH, Health and Development. Chapter in The Routledge Handbook on Water and Development (Eds. Sofie Hellberg, Fredrik Söderbaum, Ashok Swain, Joakim Öjendal).
4. Fallon, A, Lankford B., Weston, D (2021). Navigating Wicked Water Governance in the 'Solutionscape' of Science, Policy, Practice and Participation. Ecology and Society (accepted for publication).
5. Lankford, B. A., and C. F. Grasham. 2021. Agri-vector water: boosting rainfed agriculture with urban water allocation to support urban-rural linkages. Water International, 1-19.
6. Lankford, B., Closas, A., Dalton, J., López Gunn, E., Hess, T., Knox, J.W., van der Kooij, S., Lautze, J., Molden, D., Orr, S., Pittock, J., Richter, B., Riddell, P.J., Scott, C.A., Venot, J.-p., Vos, J., Zwarteveen, M. (2020) A scale-based framework to understand the promises, pitfalls and paradoxes of irrigation efficiency to meet major water challenges. Global Environmental Change 65, 102182.
7. Lankford, B.A.; Craven, J. Rapid Games Designing; Constructing a Dynamic Metaphor to Explore Complex Systems and Abstract Concepts. Sustainability 2020, 12, 7200.
8. Wiggins, S and Lankford, B. 2019. Farmer-led irrigation in sub-Saharan Africa: synthesis of current understandings. ODI and DFID-ESRC Growth Research Programme (DEGRP) Synthesis Report. <https://www.odi.org/publications/11394-farmer-led-irrigation-sub-saharan-africa-synthesis-current-understandings>
9. Wiggins, S and Lankford, B. 2019. Farmer-led irrigation in sub-Saharan Africa: building on farmer initiatives. ODI Briefing paper.
10. Fallon, A.L., Villholth, K.G., Conway, D., Lankford, B.A. and Ebrahim, G.Y., 2018. Agricultural groundwater management strategies and seasonal climate forecasting: perceptions from Mogwadi (Dendron), Limpopo, South Africa. Journal of Water and Climate Change, 10(1), pp.142-157.
11. Lankford, B.A., McCosh, J., Hess, T., Pringle, K. and Shabalala, M. 2018. Legacies, gaps, subterfuge and echo-chambers; Reflections on the absence of managed water re-allocation. Session on 'Efficiency, sufficiency, sustainability: water allocation in river basins'. Stockholm Water Week. 29 August 2018.

12. McCartney, M.P., Whiting, L., Makin, I., Lankford, B.A. and Ringler, C., 2019. Rethinking irrigation modernisation: realising multiple objectives through the integration of fisheries. *Marine and Freshwater Research* 70, 1201-1210.
13. Hooper, V and Lankford B.A. 2017. Unintended water allocation; Gaining share from the ungoverned spaces of land and water transformations in Ken Conca and Erika Weinthal, eds., *Oxford Handbook of Water Politics and Policy*. Pp 248-266. New York: Oxford University Press.
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