STEPHEN JAMES DUGDALE

Assistant Professor, School of Geography, University of Nottingham, stephen.dugdale@nottingham.ac.uk
Citizenship: British, Languages: English (native), French (fluent)

EDUCATION

PhD in Earth Sciences — Received 2014
Institut National de la Recherche Scientifique (Université du Québec), Centre Eau Terre Environnement
Thesis: *Riverscape analysis of the spatio-temporal variability of thermal refuges: Significance for Atlantic salmon (Salmo salar) populations*

MSc (by research) in Geography — Received 2008
Durham University, Department of Geography
Thesis: *An evaluation of imagery from an unmanned aerial vehicle (UAV) for the mapping of intertidal macroalgae on Seal Sands, Tees Estuary, UK*

BSc in Geography (1st class honours) — Received 2006
University of Durham, Department of Geography
Dissertation: *Evidence for late-Holocene great earthquakes and palaeo-tsunamis from Bird Point, upper Cook Inlet, Alaska*

EMPLOYMENT & RESEARCH

Assistant Professor in Physical Geography, University of Nottingham, School of Geography — **09/2018 – present**
Assistant Professor (research and teaching) in the School of Geography, University of Nottingham. Current research interests include remote sensing of rivers, river temperature dynamics and river habitat-ecosystem linkages. Currently teach and/or convene a range of BSc and MSc physical geography modules.

Marie Skłodowska-Curie research fellow, University of Birmingham, School of Geography, Earth and Environmental Sciences — **01/2017 – 09/2018**
Marie Skłodowska-Curie Independent Fellowship (IF) project integrating drones and river temperature models to understand the processes driving river temperature heterogeneity across the UK and the future impacts of land-use and climate change.

Research fellow, University of Birmingham, School of Geography, Earth and Environmental Sciences — **04/2016 – 12/2016**
Analysis of historical hydrological and water temperature data to develop new understanding of stream temperature dynamics in the UK. Support for senior academic staff in research, teaching and administrative activities.

Post-doctoral research associate, University of New Brunswick, Canadian Rivers Institute — **10/2014 – 04/2016**
Implementation of a coupled hydrological-water temperature model (CEQUEAU) to understand the impact of dam removal on the ecosystem of the lower Saint John River watershed, Canada.

PhD, Institut National de la Recherche Scientifique, Centre Eau Terre Environnement — **01/2010 – 10/2014**
Use of airborne thermal infrared imagery to map cool habitats in eastern Canadian rivers with a view to understanding the mechanisms driving temporal and spatial variability of thermal refuges and their links to salmonids.

KTP research associate, APEM Ltd and University of Durham **01/2008 – 01/2010**
Collaborative Knowledge Transfer Partnership (KTP) in conjunction with a small environmental consultancy (APEM Ltd). Project concerned with the development of new fluvial remote sensing techniques and their implementation in a software tool for the extraction of river habitat data from aerial imagery.

Field Scientist, APEM Ltd **09/2007 – 12/2007**
Member of field team employed on a variety of projects including riverine macrophyte surveys, juvenile fish population monitoring, water quality monitoring, pollution incident response.

RESEARCH INTERESTS

I am a physical geographer with broad interests in remote sensing and river processes. I use novel geospatial and modelling approaches to understand the links between river habitats and ecosystems (fisheries), river temperature dynamics, and climate change. I have pushed the boundaries of river remote sensing method development for over 10 years and have pioneered its application for furthering fundamental understanding of river processes and ecosystem response.

AWARDS & RECOGNITION

INRS (Centre Eau Terre Environnement) prize for best doctoral thesis **2015**
Institut National de la Recherche Scientifique, Centre Eau Terre Environnement

MiTACS Award for Outstanding Innovation **2014**
Recipient of first prize for Outstanding Innovation (PhD) awarded by MiTACS (Canadian research council focusing on academia-industry collaboration).

2nd most popular article in *Remote Sensing of Environment* by Altmetric score **2013**

Best poster by a PhD student **2013**
Groupe de recherche interuniversitaire en limnologie et environnement aquatique (GRIL) annual symposium, 28th February – 3rd March, Lac Morency, Québec, Canada

Best oral presentation **2007**
Remote sensing and photogrammetry society (RSPSoC) annual student meeting, 22nd – 24th March, University of Edinburgh, Edinburgh, UK

GRANTS, STUDENTSHIPS AND OTHER FUNDING

UKRI / MiTACS UK-Canada Globalink exchange scheme **2022**
Satellite remote sensing of river discharge during snowmelt
PI: **Dugdale**, Co-I: Boyd, Valman (£14,251)

Gespe'gewaq Mi'gmaq Resource Council / Canada Nature Fund for Aquatic Species at Risk **2022**
Thermal infrared mapping of the Nepisiguit River, New Brunswick, Canada: quantification of thermal heterogeneity and spatial distribution of cool water refuges
PI: **Dugdale** (£21,012)

University of Nottingham IRC Flexible Research Fund **2022**
Monitoring river ecosystem health under changing climate (Part I): Predicting emerging risks for water pollution
PI: **Dugdale**, Co-I: Hartikainen, Boyd, Zieritz, Blunt, Johnson (£19,914 GBP)

NERC Discipline Hopping Fund **2022**
Pump-priming the Nottingham River Observation Network (NRON) to enhance sustainable global freshwater resources limits
PI: Hartikainen, Co-I: **Dugdale**, Boyd, Zieritz, Blunt (£19,789)

SCIMABIO Interface **2021**
Establishing a framework for the best-practise thermal infrared monitoring of river habitats
PI: **Dugdale** (£10,989 CAD)

NERC Urgency Grant **2021**
Synergistic Fire and Floodplain Solutions
PI: Field, Co-I: **Dugdale**, Johnson, Mariani, Schrodt, Thorne (£64,929 GBP)

University of Nottingham IRC Flexible Research Fund **2020**
Monitoring river ecosystem health under changing climate (Part I): Predicting emerging risks for water pollution
PI: Feng, Co-I: Chan, Ren, Gibbins, Maul, Johnson, **Dugdale** (£15,000 GBP)

University of Nottingham IRC Initiative Fund **2020**
Delivering Blue-Green infrastructure to drive economic growth and place making: a case study of the River Leen, Nottinghamshire
PI: O'Donnell, Co-I: Johnson, **Dugdale**, Fraser, Chan, Gibbins (£59,431 GBP)

University of Nottingham IS Digital Initiatives Fund **2020**
Enhanced digital terrain modelling with cloud-based structure from motion photogrammetry. PI: **Dugdale**, Co-I: Donelan (£4,000 GBP)

Leverhulme Trust *(awarded but withdrawn due to acceptance of permanent academic post)* **2018**
Leverhulme Early Career Fellowship (ECF): *R-THERmo (River Thermal Heterogeneity and Ecosystem Resilience)* project (£75,000 GBP)

EU Horizon 2020 (Marie Skłodowska-Curie Actions) **2017-2018**
Marie Skłodowska-Curie Individual Fellowship (IF): *HoTRiverS (Heterogeneity of Temperature* in Rivers and Streams) project (€195,454.80 EUR)

EU Horizon 2020 (INTERACT Transnational Access) **2017**
Transnational Access funds to support fieldwork at Svartberget Research Station, Sweden
PI: **Dugdale.** Co-I: Brekenfeld, Hannah, Krause (€2,500 EUR)

Atlantic Salmon Conservation Foundation **2015-2016**
Funding for aerial photography to identify critical thermal refuges in eastern Canadian rivers
PI: Gray. Co-I: Bergeron, Curry, **Dugdale** ($27,700 CAD)

MiTACS Accelerate **2013-2014**
6 months collaborative research studentship ($15,000 CAD)

PhD studentship, Institut National de la Recherche Scientifique **2010-2014**
4yr PhD studentship ($25,000 CAD p/a)

Northumbrian Water Ltd **2006-2007**
MSc stipend (£6,000 GBP)

ACADEMIC SERVICE

Course Director for BSc Geography (F800), BSc Environmental Geoscience (F630) and BSc Environmental Science 2+2 (F579) programmes in School of Geography, University of Nottingham — **2021-present**

Education and Student Experience Committee member for School of Geography, University of Nottingham — **2021-present**

Postgraduate certificate in Higher Education (PGCHE) and Fellow of the Higher Educational Academy — **2021**
University of Nottingham / AdvanceHE

Digital Research Lead for School of Geography, University of Nottingham — **2020-present**

Ad-hoc journal reviewer for: *Nature Communications, Environmental Research Letters, Water Resources Research, Remote Sensing of Environment, Science of the Total Environment, Hydrology and Earth System Sciences, Ecology of Freshwater Fish, Earth Surface Processes and Landforms, Journal of Environmental Management, Hydrological Processes, Journal of Hydrology, Geophysical Research Letters, Water, Remote Sensing of Ecology and Conservation, Water Quality Research Journal of Canada, Thermal Biology, Journal of Ecohydraulics, Urban Water Journal, PeerJ, PLOSOne, River Research and Applications* — **2013-present**

Ad-hoc research proposal reviewer for: *National Science Foundation (NSF, USA); Natural sciences and engineering research council (NSERC, Canada); German Research Foundation (DFG), National Science Centre (NCN, Poland)* — **2017 - present**

Level 5 Diploma in Management — **2009**
Chartered Management Institute

TEACHING AND SUPERVISION

University of Nottingham — **2018 - present**
Convene/lecture on: GEOG3033 (Geophysics and Geological Mapping), GEOG3034 (Practical River Restoration and Management), GEOG4088 (Advances in Managing Rivers and Catchments)

Lecture/teach on: GEOG1005 (Tutorial), GEOG2030 (Research Tutorial), GEOG2031 (Dissertation Preparation), GEOG3004 (Dissertation), GEOG3028 (Environmental Modelling), GEOG3055 (Advances in Remote Sensing), GEOG4084 (Project in Environmental Leadership and Management), ENGR4015 (GIS and Earth Observation)

Currently supervising 6x PhD students (4x co-lead supervisor, 2x third supervisor)

University of Birmingham — **2016-2018**
Lecture/practical teaching on: GGM314 (Applied Micrometeorology), GG506 (Environmental Analysis and Modelling)

Supervised 1x MSc student

Institut National de la Recherche Scientifique — **2014**
Lecture on: GEO9701 (River Forms and Processes)

Durham University **2006-2007**
Tutor and subject demonstrator for GEOG1222 (Introduction to Physical Geography), GEOG2591 (GIS and Remote Sensing) and GEOG3261 (Environmental Remote Sensing)

ORGANISATION OF CONFERENCES/WORKSHOPS

Co-convenor, AGU 2017 sessions EP34B and EP31C **2017**
Co-convenor of sessions EP34B and EP31C: *Remote Sensing of Rivers: Observations Across Scales (I & II)* at the American Geophysical Union Fall Meeting 2017, New Orleans, LA

Organising committee, HydroEco 2017 **2017**
Organising committee of HydroEco 2017, 6th International Multidisciplinary Conference on Hydrology and Ecology, Birmingham UK. Convenor of session S5: 'Linking hydroecology and ecohydraulics'.

Co-organiser, CEQUEAU workshop, Rabat, Morocco **2015**
Co-organiser/presenter of two-day workshop (PhD level) on the CEQUEAU hydrological model held in Rabat, Morocco. Involved presentation of model's theoretical background and practical classes on GIS and execution of hydrological model.

Organising committee, NoWPaS annual workshop **2013-2016**
Co-organiser of 2013 and 2016 NoWPaS (European (Nordic) Workshop of PhD and Post-Doctoral fellows on anadromous Salmonids) annual workshop. Secured conference funding from a variety of sources. Also associate committee of NoWPaS 2014-2015 and voluntary webmaster (www.nowpas.eu) since 2013.

MEMBERSHIP OF PROFESSIONAL ORGANISATIONS

American Geophysical Union **2009 - present**
European Geosciences Union **2017 - present**
International Association for Hydro-Environment Engineering and Research **2019 - present**

REFEREED RESEARCH PUBLICATIONS

Dugdale, SJ, Klaus, J., & Hannah, D.M. 2022. Looking to the Skies: Realising the Combined Potential of Drones and Thermal Infrared Imagery to Advance Hydrological Process Understanding in Headwaters. *Water Resources Research*, 58, e2021WR031168

Pugh, B.E., Colley, M., **Dugdale, S.J**., Edwards, P., Flitcroft, R., Holz, A., Johnson, M., Mariani, M., Means-Brous, M., Meyer, K., Moffett, K.B., Renan, L., Schrodt, F., Thorne, C., Valman, S., Wijayratne, U., & Field, R. (2022). A possible role for river restoration enhancing biodiversity through interaction with wildfire. *Global Ecology and Biogeography*, DOI: 10.1111/geb.13555

Torgersen, CE, Le Pichon, C, Fullerton, AH, **Dugdale, SJ**, Duda, JJ, Giovannini, F, Tales, E, Belliard, J, Branco, P, Bergeron, NE, Roy, ML, Tonolla, D, Lamouroux, N, Capra, H, Baxter, CV. 2021. Riverscape approaches in practice: perspectives and applications. *Biological Reviews*, DOI: 10.1111/brv.12810

Ouellet, V, St-Hilaire, A, Secretan, Y, Mingelbier, M, Morin, J, & **Dugdale, SJ**. 2021. The Importance of Including Water Temperature Simulations in a 2D Fish Habitat Model for the St. Lawrence River. *Water, 13*, 1736

Rodríguez Valido, CA, Johnson, MF, **Dugdale, SJ**, Cutts, V, Fell, HG, Higgins, EA, Tarr, S, Templey, CM, & Algar, AC. 2021. Thermal sensitivity of feeding and burrowing activity of an invasive crayfish in UK waters. *Ecohydrology*, 14, e2258

Carbonneau, PE, **Dugdale, SJ**, Breckon, TP, Dietrich, JT, Fonstad, MA, Miyamoto, H, & Woodget, AS. 2020. Adopting deep learning methods for airborne RGB fluvial scene classification. *Remote Sensing of Environment, 251*, 112107

Dugdale, SJ, Hannah, DM, & Malcolm, IA. (2020). An evaluation of different forest cover geospatial data for riparian shading and river temperature modelling. *River Research and Applications, 36*, 709-723

Ouellet, V, St-Hilaire, A, **Dugdale, SJ**, Hannah, DM, Krause, S, & Proulx-Ouellet, S. (2020). River temperature research and practice: Recent challenges and emerging opportunities for managing thermal habitat conditions in stream ecosystems. *Science of The Total Environment, 736*, 139679

Corey, E, Linnansaari, T, **Dugdale, SJ**, Bergeron, N, Gendron, J-F, Lapointe, M, & Cunjak, RA. 2020. Comparing the behavioural thermoregulation response to heat stress by Atlantic salmon parr (*Salmo salar*) in two rivers. *Ecology of Freshwater Fish, 29*, 50-62

Dugdale SJ, Malcolm, IA, Hannah, DM. 2019. Drone-based Structure-from-Motion provides accurate forest canopy data to assess shading effects in river temperature models. *Science of the Total Environment*, 678, 326-340

Borg Galea, A, Sadler, JP, Hannah, DM, Datry, T, & **Dugdale, SJ**. 2019. Mediterranean intermittent rivers and ephemeral streams: Challenges in monitoring complexity. *Ecohydrology*, 12, e2149

Dugdale, SJ, Kelleher, CA, Malcolm, IA, Caldwell, S and Hannah, DM. 2019. Assessing the potential of drone-based thermal infrared imagery for quantifying river temperature heterogeneity. *Hydrological Processes*, 33, 1152-1163

Docherty, CL, **Dugdale, SJ**, Milner, AM, Abermann, J, Lund, M, & Hannah, DM. 2019. Arctic river temperature dynamics in a changing climate. *River Research and Applications*

Dugdale, SJ, Curry, RA, St-Hilaire, A, & Andrews, SN. 2018. Impact of Future Climate Change on Water Temperature and Thermal Habitat for Keystone Fishes in the Lower Saint John River, Canada. *Water Resources Management*, 32, 4853-4878

Marruedo Arricibita, AI, **Dugdale, SJ**, Krause, S, Hannah, DM, & Lewandowski, J. 2018. Thermal infrared imaging for the detection of relatively warm lacustrine groundwater discharge at the surface of freshwater bodies. *Journal of Hydrology*, 562, 281-289

Frechette, D, **Dugdale, SJ**, Dodson, J, Bergeron, NE. 2018. Understanding summertime thermal refuge use by adult Atlantic salmon using remote sensing, river temperature monitoring, and acoustic telemetry. *Canadian Journal of Fisheries and Aquatic Sciences*, 75, 1999-2010

Gillis, C-A, **Dugdale, SJ**, Bergeron, NE. 2018. Effect of discharge and habitat type on the occurrence and severity of *Didymosphenia geminata* in the Restigouche River, eastern Canada. *Ecohydrology*, 11, e1959

Loicq, P, Moatar, F, Jullian, Y, **Dugdale, SJ**, Hannah, DM. 2018. Improving representation of riparian vegetation shading in a regional stream temperature model using LiDAR data. *Science of the Total Environment*, 624, 480-490

Dugdale, SJ, Malcolm, IA, Kantola, K, Hannah, DM. 2018. Stream temperature under contrasting riparian forest cover: Understanding thermal dynamics and heat exchange processes. *Science of the Total Environment*, 610-611, 1375-1389

Thomas, RM, MacKenzie, AR, Reynolds J, Sadler, JP, Cropley, F, Bell, S, **Dugdale, SJ**, Chapman, L, Quinn, A, Cai, X. 2018 Avian Sensor Packages for Meteorological Measurements. *Bulletin of the American Meteorological Society,* 99, 499-511

Dugdale, SJ, Hannah, DM, Malcolm IA. 2017. River temperature modelling: a review of deterministic approaches and future directions. *Earth Science Reviews*. 175, 97-113

Folegot, S, Hannah, DM, **Dugdale, SJ**, Kurz, MJ, Drummond, JD, Klaar, MJ, Lee-Cullin, J, Keller, T, Martí, E, Zarnetske, JP, Ward, A, Krause, S. 2017. Low flow controls on stream thermal dynamics. *Limnologica, 68, 157-167*

Dugdale, SJ, St-Hilaire, A, Curry, RA. 2017. Automating physiography and flow routing inputs to the CEQUEAU hydrological model: sensitivity testing on the St. John River Watershed. *Journal of Hydroinformatics*, 19, 4, 469-492

Mellor, CJ, **Dugdale, SJ**, Garner, G, Milner, AM, Hannah, DM. 2016. Controls on Arctic glacier-fed river water temperature. *Hydrological Sciences Journal*, 62, 4, 499-514

Dugdale, SJ. 2016**.** A practitioner's guide to thermal infrared remote sensing of rivers and streams: Recent advances, precautions and considerations. *Wiley Interdisciplinary Reviews: Water*, 3, 251-268

Dugdale, SJ, Franssen, J, Corey, E, Bergeron, NE, Lapointe, M, Cunjak, R. 2016. Main stem movement of juvenile Atlantic salmon in response to high water temperature. *Ecology of Freshwater Fish,* 25, 429-445.

Dugdale, SJ, Bergeron, NE, St-Hilaire, A. 2015. Spatial distribution of thermal refuges analysed in relation to riverscape hydromorphology using airborne thermal infrared imagery. *Remote Sensing of Environment,* **160***,* 43-55

Dugdale, SJ, Bergeron, NE, St-Hilaire, A. 2013. Temporal variability of thermal refuges and water temperature patterns in an Atlantic salmon river. *Remote Sensing of Environment*, **136**, 358-373

Carbonneau, P, Fonstad, M, Marcus, WA, **Dugdale, SJ**. 2011. Making Riverscapes Real. *Geomorphology*, **137**(1), 74-86

Dugdale, SJ, Carbonneau, P, Campbell, S. 2010. Aerial photosieving of exposed gravel bars for the rapid calibration of airborne grain size maps. *Earth Surface Processes and Landforms*, **35**(6), 627-639

Carbonneau, P, **Dugdale, SJ**, Clough, S. 2010. An automated georeferencing tool for watershed scale fluvial remote sensing. *River Research and Applications,* **26**(5), 650-658

Wilby RL, Orr, H, Watts G, Battarbee GW, Berry, PM, Chad, R, **Dugdale, SJ**, Dunbar, MJ, Elliott, JA, Extence, C, Hannah, DM, Holmes, N, Johnson, AC, Knights, B, Milner, NJ, Ormerod, SJ, Solomon, D, Timlett, R, Whitehead, PJ, Wood, PJ. 2010. Evidence needed to manage freshwater ecosystems in a changing climate: Turning adaptation principles into practice. *Science of the Total Environment*, **408**, 4150-4164

RESEARCH PUBLICATIONS CURRENTLY UNDER REVIEW/IN PREPARATION

Dugdale, SJ, Klaus, J & Hannah, DM. Looking to the skies: realising the potential of drones to advance hydrological process understanding in headwaters. In review (major revisions, currently working on revised manuscript) for *Water Resources Research*

Dugdale, SJ, Hannah, DM, Malcolm, IA. Quantifying stream temperature moderation by existing new riparian tree planting schemes: sensitivity testing and future best practice. For submission to *Journal of Hydrology*.

Valman, S, Johnson, MF, **Dugdale, SJ** & Ives, C. The criteria conundrum: Hydrological, ecological, chemical and morphological environmental variables result in inconsistent classifications of Anthropogenic streams. For re-submission to *River Research and Applications*.

REFEREED REPORTS AND PROCEEDINGS

Dugdale, SJ, St-Hilaire, S, Curry, RA. 2017. *Hydrological and water temperature modelling for dam decommissioning and climate change studies*. Proceedings of the 10th World Congress of EWRA 'Panta Rhei', 5-9 July 2017, Athens, Greece. European Water Resources Association: 417-423.

St-Hilaire, A, Boucher, M-A, Chebana, F, Ouellet-Proulx, S, Zhou, Q, Larabi, S, **Dugdale, SJ**, Latraverse, M. 2015. *Breathing a new life to an older model: the CEQUEAU tool for flow and water temperature simulations and forecasting*. Proceedings of the 22nd Canadian Hydrotechnical Conference, April 29th - May 2nd, Montréal, Québec, Canada

Benyahya, L, St-Hilaire, A, Caissie, D, Bergeron NE, Curry, RA, Clarke, K, El-Jabi, N, **Dugdale, SJ**. 2014. *Workshop on the development & implementation of a water temperature monitoring network for Atlantic Salmon (Salmo salar) rivers in eastern Canada held in Quebec City, Quebec, 22-23 January 2014: Abstracts and proceedings*. Canadian Manuscript Report of Fisheries and Aquatic Sciences 3045, **VI**, 14 p

Carbonneau, P, **Dugdale, SJ**, Clough, S. 2009. *The Fluvial Information System*. Proceedings of the GIS Research UK 17th Annual Conference, 1st - 3rd April, Durham University, Durham, UK

INVITED CONFERENCE PRESENTATIONS/KEYNOTES

Dugdale SJ, Hannah, DM, Malcolm IA. 2022. *River temperature mitigation via riparian planting: developing applied guidance for practitioners and managers*. Workshop on approaches to mitigate the influences of climate and environmental change on river and stream temperature. 19th – 20th May, Institute for Global Innovation, University of Birmingham, UK

Dugdale SJ. 2022. *Remote sensing of river temperature in a changing climate: from knowledge to applied river management*. Methods for Ecohydraulics: Remote Sensing. 17th – 20th May, Institute of Geophysics, Polish Academy of Sciences

Invited discussant at SESYNC Coldwater Refuge Workshop, 14th, 15th, 21st and 28th January 2021, National Socio-Environmental Synthesis Center, University of Maryland, Annapolis, MD, USA (held online due to COVID-19)

Dugdale SJ. 2020. *Using drones to better understand river temperature patterns in a changing climate*. Virtual Remote Sensing of Rivers Symposium. 19th May, University of Northern Iowa/Durham University (held online due to COVID-19)

Dugdale SJ, Hannah, DM, Malcolm, IA. 2017. *Drone-based thermal imaging of river temperature heterogeneity: the HoTRiverS project*. EnviroDrones Workshop, 4th-5th June, Dartmouth College, Hanover, NH, USA

Dugdale SJ. 2017. *Télédétection des milieux fluviaux*. ASCF-CRI 2016-2017 webinar series, 14th March, Atlantic Salmon Conservation Foundation/Canadian Rivers Institute, New Brunswick, Canada.

Dugdale, SJ, Hannah, DM, Malcolm, IA, Bergeron, NE, St-Hilaire, A. 2016. *Thermal infrared remote sensing for riverscape analysis of water temperature heterogeneity: current research and future directions*. American Geophysical Union (AGU) Fall Meeting, 12th – 16th December, San Francisco, USA

Dugdale, SJ. 2016. *Thermal infrared imaging of temperature patterns and cool water anomalies in rivers and streams*. International Atomic Energy Agency (IAEA) Technical Meeting on the Coupled Use of Isotope Tracers and Satellite/Remote Sensing Data in Water Resources Assessment and Management. 7th – 10th November, Vienna, Austria

Dugdale, SJ. 2016. *Mapping the Riverscape: tools, techniques and thoughts for the future.* Putting the riverscape perspective into practice: Workshop on the state of the science and future directions in freshwater management. 22nd-24th June, Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture (IRSTEA), Paris, France

Dugdale, SJ, Bergeron, NE, St-Hilaire, A. 2015. *Understanding Riverscape-Scale Patterns of Thermal Refuge Distribution in Relation to Landscape Hydromorphology in an Eastern Canada Watershed.* American Fisheries Society (AFS) Annual Meeting, 16th-20th August, Portland (OR), USA

Dugdale, SJ. 2015. *Analysis of the spatio-temporal variability of thermal refuges across the riverscape using thermal infrared (TIR) imagery*. Physical Geography Seminar series, 13th February, Department of Geography, Durham University

Dugdale, SJ. 2014. *Remote Sensing of River Environments*. EcoLac-GRIL Autumnal Workshop, 7th-9th November, Station de biologie des Laurentides, Université de Montréal, Canada

CONFERENCE PRESENTATIONS AND POSTERS

Dugdale, SJ. 2020. *Combining drones and numerical models to better understand river temperature patterns in a changing climate*. 13th International Symposium on Ecohydraulics, March 23-29, Lyon, France. Conference cancelled due to COVID-19.

Hannah, DM, Jackson, FL, **Dugdale, SJ,** Garner, G, Ouellet, V, Malcolm I. 2019. *Advancing knowledge of river temperature sensitivity to climate and other drivers of change.* American Geophysical Union (AGU) Fall Meeting 2019, 9-13 December, San Francisco, CA, USA

Dugdale, SJ, Hannah, DM & Malcolm, IA. 2018. *Utility of drone-based thermal imaging for mapping river temperature heterogeneity*. American Geophysical Union (AGU) Fall Meeting 2018, 10th – 14th December, Washington, DC

Dugdale, SJ, Hannah, DM & Malcolm, IA. 2018. *Integrating structure-from-motion photogrammetry and process-based river temperature modelling for improved characterisation of riparian shading*. Proceedings of the European Geosciences Union 20th Annual General Assembly, 4-13 April, 2018 in Vienna, Austria

Dugdale, SJ, Hannah, DM & Malcolm, IA. 2017. *Understanding river temperature heterogeneity using UAV-based remote sensing and process-based river temperature models*. American Geophysical Union (AGU) Fall Meeting 2017, 11th – 15th December, New Orleans, LA

Dugdale SJ, Hannah, DM, Malcolm, IA. 2017. *Characterising river temperature heterogeneity using UAV-based thermal infrared remote sensing and deterministic river temperature models*. HydroEco 2017, the 6th

International Multidisciplinary Conference on Hydrology and Ecology, 18th-23rd June, University of Birmingham, Birmingham, UK

Dugdale, SJ, St-Hilaire, A. 2015. *Development of a coupled hydrological-water temperature model of the St John River watershed : Utility for Environmental Flow Assessment*. Developing environmental flows for Wolastoq / Saint John River / Fleuve Saint-Jean Workshop 2: Developing flow-ecology hypotheses. 27th - 28th October, University of New Brunswick, New Brunswick, Canada

Dugdale, SJ, Bergeron, NE, St-Hilaire, A. 2015. *Spatial Variability of Thermal Refuges Analysed in Relation to Landscape Hydromorphology in the Restigouche River Watershed.* American Geophysical Union – Canadian Geophysical Union (AGU-CGU) Joint Assembly, 3rd-7th May, Montréal, Canada

Dugdale, SJ, Bergeron, NE, St-Hilaire, A. 2014. *Variabilité spatiale des refuges thermiques reliée à la géomorphologie du paysage du bassin versant de la rivière Restigouche*. 17ème colloque annuel du Centre Interuniversitaire de Recherche sur le Saumon Atlantique (CIRSA), 6st-7nd May, Université Laval, Québec, Canada

Dugdale, SJ, Franssen, J, Bergeron, NE, Lapointe, M, Corey, E, Cunjak, R. 2014. *Reach-scale movement of Atlantic salmon in response to summer high temperature events in a thermally-stressed river*. NoWPaS (European (Nordic) Workshop of PhD and Post-Doctoral fellows on anadromous Salmonids) meeting 2014. 8th – 11th April, Värmland, Sweden

Dugdale, SJ, Bergeron, NE, St-Hilaire, A. 2014. *Linking spatio-temporal variability of thermal refuges in Atlantic salmon rivers to hydrometeorology and landscape geomorphology.* River Temperature: a Physical, Biological and Climate Change Perspective, Canadian Water Resources Association regional conference, 5th – 6th March, Moncton, NB, Canada

Dugdale, SJ, Bergeron, NE, St-Hilaire, A. 2013. *Temporal variability of thermal refuges and water temperature patterns in an Atlantic salmon river*. American Geophysical Union (AGU) Fall Meeting, 9th – 13th December, San Francisco, USA

Bergeron, NE, Calsamiglia, A, **Dugdale, SJ**, Bérubé, F. 2013. *Remote mapping of river gravel interstitial space availability for juvenile salmon sheltering*. American Geophysical Union (AGU) Fall Meeting, 9th – 13th December, San Francisco, USA

Dugdale, SJ, Bergeron, NE, St-Hilaire, A. 2013. *Importance des conditions hydrométéorologiques sur l'abondance des refuges thermiques et la structure spatiale de la température de l'eau d'une rivière à saumon*. 16ème colloque annuel du Centre Interuniversitaire de Recherche sur le Saumon Atlantique (CIRSA), 1st-2nd May, Université Laval, Québec, Canada

Dugdale, SJ, Bergeron, NE, St-Hilaire, A. 2013. *Importance des conditions hydrométéorologiques sur la structure spatiale de la température de l'eau d'une rivière à saumon*. RHQ2013: La recherche hydrologique au Québec dans un contexte de changements climatiques. 25th – 26th April, Québec, Québec, Canada

Dugdale, SJ, Bergeron, NE, St-Hilaire, A. 2013. *Assessing the temporal variability of salmonid thermal refuges and river temperature patterns using airborne thermal infrared imagery*. NoWPaS (European (Nordic) Workshop of PhD and Post-Doctoral fellows on anadromous Salmonids) meeting 2013. 3rd – 6th April, Machynlleth, Wales, UK

Dugdale, SJ, Bergeron, NE, St-Hilaire, A. 2013. *Assessing the temporal variability of salmonid thermal refuges and river temperature complexity using airborne TIR imagery*. Groupe de recherche interuniversitaire en limnologie et environnement aquatique (GRIL) annual symposium, 28th February – 3rd March, Lac Morency, Québec, Canada

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