

## A review of water-related serious games to specify use in environmental Multi-Criteria Decision Analysis

Aubert, Alice H.<sup>a, c</sup>; Bauer, René<sup>b</sup>; Lienert, Judit<sup>a</sup>

<sup>a</sup> Environmental Social Sciences department, Eawag: Swiss Federal Institute of Aquatic Science and Technology, Überlandstrasse 133, CH-8600 Dübendorf, Switzerland

<sup>b</sup> Game Design, Zürich University of the Arts, Toni-Areal, Pfingstweidstrasse 96, Postfach, CH-8031 Zürich, Switzerland

<sup>c</sup> Corresponding author: Telephone +41(0)58 765 56 88, e-mail: [alice.aubert@eawag.ch](mailto:alice.aubert@eawag.ch)

This document complements the above mentioned paper. It contains:

- Table SI1. Characteristics of the reviewed serious games related to water issues
- Table SI2. Direct link and reference to the reviewed serious games related to water issues.

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**Table SI1.** Characteristics of the reviewed serious games related to water issues. Games are numbered in alphabetical order.

Legend for Table SI1

- **Purpose:** Mes (broadcast a message), Dat (exchange information), Tra (training)
- **Water issue:** IWRM: Integrated Water Resource Management
- **Target player:** Water experts (water manager, water practitioners, higher education students), Decision-makers (policy makers, local decision makers), Laypeople (any non-expert on water issue)
- **Technology:** IT (information technology), Hybrid (IT+board game), Board Game, Low tech (No/Few paraphernalia)
- **Number of players:** 1 (single player), 1\* (single player with online community), Multi (multi player)
- **Fun-serious degree:** S (gamified application), s (serious game based on scientific model and real-world data), f (serious game based on simplified models and real-world data), F (fully-fledged games)
- **Game place:** Online, Meeting room (or classroom), Other (not so strict as the previous)

Number	Game title	Author/ owner institutions	Year	Purpose	Water issue	Target player	Technology	Number of players	Fun-serious degree	Game time (approximate)	Game place
1	Aqua Republica	UNEP-DHI centre for water and environment	2012	Mes	IWRM	Water experts, Decision-makers	IT (tile-based)	1*	s	30 min	Online
2	AtollGame	Australian national university and Cirad (agricultural research for development)	2006	Mes, Dat	IWRM	Decision-makers, Laypeople (adult)	Hybr	Multi	s	2 d	Meeting room
3	AWQA Water	Wilson, M.	2008	Tra	Quality	Laypeople (child)	IT	1	f	15 min	Online
4	Catchment Detox (the basin challenge)	ABC science	2013	Mes	IWRM	Laypeople	IT (tile-based)	1*	f	45 min	Online
5	Cauldron	Climate center red cross/ red crescent	2015	Mes	Risk (scarcity for farming)	Laypeople (adult)	Low tech	Multi	F	90 min	Other
6	Contaminator	iMoMo Hydrosolutions	2014	Mes	Quality	Laypeople	IT	1	F	5 min	Online
7	Darfur is dying	mtvu	2006	Mes	Risk (scarcity, hygiene & sanitation)	Laypeople	IT	1	F	30 min	Online
8	Fish Game	The cloud institute for sustainability education	NA	Mes	Sustainable fishing	Laypeople (child)	IT	1/ Multi	F	10 min	Online
9	Floodsim	Playgen	2008	Mes, Dat	Risk (flood)	Laypeople (adult)	IT	1	f	20 min	Online
10	Flood-WISE	Play-Time and Hastjns	2012	Mes, Dat	Risk (flood)	Water experts, Decision-makers	Low tech	Multi	f	2 to 3 h	Meeting room
11	Irrigania	University of Zurich	2012	Mes	IWRM, Risk (scarcity for farming)	Water experts	IT	Multi	s	3 h	Meeting room

Number	Game title	Author/ owner institutions	Year	Purpose	Water issue	Target player	Technology	Number of players	Fun-serious degree	Game time (approximate)	Game place
12	L' eau c' est plus qu' un jeu	Swiss federal office for the environment	2012	Mes	IWRM	Laypeople	IT (tile-based)	1	f	45 min	Online
13	Lords of the valley	Center for systems solutions	NA	Mes, Dat	IWRM	Decision-makers, Laypeople	Board game	Multi	s	1 to 2 h	Other
14	Meru	iMoMo Hydrosolutions	2014	Mes	Risk (scarcity for farming)	Laypeople (child)	Board game	Multi	F	20 min	Other
15	Mission H2O	Swinburne University	2008	Mes	Risk (scarcity for household)	Laypeople (child)	IT	1	F	30 min	Online
16	Ni trop, ni trop peu, nitrogène	Inra (French agricultural research institute)	2012	Mes	Quality	Laypeople	Board game	Multi	F	20 min	Other
17	Njoobari	irstea, Cirad, and Inra	2001	Mes, Dat	Risk (scarcity for farming)	Decision-makers, Laypeople (adult)	Hybrid	Multi	s	1 d	Meeting room
18	NoMIX tool	FIBL and Eawag	2003	Mes	IWRM (urban water)	Laypeople (adult)	IT	1	S	30 min	Online
19	Paying for predictions	Climate center red cross/ red crescent	2015	Mes	Risk (scarcity, flood)	Decision-makers, Laypeople (adult)	Low tech	Multi	F	45 to 60 min	Other
20	Reef game	Australian national university, CSIRO marine and atmospheric research and conservation international	2010	Mes, Dat	Sustainable fishing	Decision-makers, Laypeople (adult)	Hybrid	Multi	s	1 d	Meeting room
21	ReNUWit Water/City Design Challenge	ReNUWit/ Lawrence Hall of Science	2013	Mes	IWRM (urban water)	Laypeople	Low tech	1	F	30 min	Other
22	Run the river	Murray-Darling basin authority	2014	Mes	IWRM	Laypeople	IT	1	f	30 min	Online

Number	Game title	Author/ owner institutions	Year	Purpose	Water issue	Target player	Technology	Number of players	Fun-serious degree	Game time (approximate)	Game place
23	Shumbara	iMoMo Hydrosolutions	2014	Mes	Risk (scarcity for farming)	Laypeople (child)	Board game	Multi	F	20 min	Other
24	SmartH20	Idisia and other research partners	2014	Mes, Dat	IWRM (urban water)	Laypeople (adult)	IT	1*	F	10 min	Online
25	SOS mission eau	SEDIF	2014	Mes	Urban water	Laypeople (child)	IT	1	F	30 min	Online
26	Stop disasters!	UN / International Strategy for disaster Reduction	NA	Mes	Risk (flood)	Laypeople	IT (tile-based)	1*	f	20 min	Online
27	Sustainable delta	Deltares	2012	Mes, Dat	IWRM	Water experts, Decision-makers	Hybrid	Multi	s	1 d	Meeting room
28	System_blue	ResEAU Share-Web	NA	Mes	IWRM	Laypeople	IT	1	F	30 min	Online
29	Tip Tank, water use it wisely	Park&Co	2003	Mes	Risk (scarcity for household)	Laypeople (child)	IT	1	F	10 min	Online
30	The gender and climate game (2nd edition: Gender walk)	Climate center red cross/ red crescent	2014	Mes	Risk (scarcity, flood)	Laypeople	Low tech	Multi	F	30 min	Other
31	The river Wadu role play (or the irrigation management game)	University of London	1989	Tra	IWRM, Risk (scarcity for farming)	Water experts	Low tech	Multi	S	1 d	Meeting room
32	Thirsty for knowledge	US EPA, water sense	NA	Mes	Risk (scarcity for household)	Laypeople (child)	IT	1	F	10 min	Online
33	Traveling with N on the hills/lope	University of Giessen	2015	Mes	Quality	Laypeople (child)	Low tech	Multi	F	1 to 2 h	Meeting room

Number	Game title	Author/ owner institutions	Year	Purpose	Water issue	Target player	Technology	Number of players	Fun-serious degree	Game time (approximate)	Game place
34	TWIST++/ Visimple	Takomat	2014	Mes	IWRM (urban water)	Laypeople (child)	IT	1*	S	60 min	Online
35	WASH game	Eawag	2010	Mes	Risk (hygiene & sanitation)	Laypeople (adult)	IT	1	F	30 min	Online
36	Wat-a-game	Irs tea	2009	Mes, Dat	IWRM	Decision-makers, Laypeople (adult)	Low tech/ Hybrid	Multi	S	4 to 5 h	Meeting room
37	Water busters	Home water conservation USA	2006	Mes	Risk (scarcity for household)	Laypeople (child)	IT	1	F	20 min	Online
38	Water coach	Deltares	2012	Tra	Risk (flood)	Water experts, Decision-makers	IT	Multi	S	1 to 2 d	Meeting room
39	Water life: sea turtles and the quest to nest (2nd ed)	NOAA	2014	Mes	Sustainable fishing	Laypeople (child)	IT	1	F	60 min	Online
40	Water life: where rivers meet the sea (2nd ed)	NOAA	2009	Mes	Quality	Laypeople (child)	IT	1	F	60 min	Online
41	Water wars	University of Washington Seattle	2010	Mes	IWRM, Risk (scarcity for farming)	Laypeople (adult)	IT (tile-based)	Multi	f	4 h	Online
42	Wastewater RPG	University of Girona	2009	Mes, Dat	IWRM (urban water)	Water experts, Decision-makers	Hybrid	Multi	S	1 d	Meeting room
43	World Water Game	Deltares/ Softonic	2000	Mes	IWRM, Risk (scarcity for farming)	Laypeople (adult)	IT	1	S	2 h	Online

**Table S12.** Direct link and reference to the reviewed serious games related to water issues. Games are numbered in alphabetical order. NA: not available.

Number	Game title	Links (retrieved on 27.06.2017)	Reference (if available)
1	Aqua Republica	<a href="http://aquarepublica.com/about/about-the-game/">http://aquarepublica.com/about/about-the-game/</a>	NA
2	AtollGame	<a href="http://cormas.cirad.fr/en/applica/atollGame.htm">http://cormas.cirad.fr/en/applica/atollGame.htm</a>	Dray, A., Perez, P., Le Page, C., D'Aquino, P. & White, I. Who wants to terminate the game? The role of vested interests and metaplayers in the ATOLLGAME experience. <i>Simulation &amp; Gaming</i> 38, 494-511, doi:10.1177/1046878107300673 (2007). Dray, A. et al. The atollgame experience: From knowledge engineering to a computer-assisted role playing game. <i>JASSS</i> 9 (2006).
3	AWQA Water	<a href="http://alms.ca/wp-content/uploads/2013/09/AWQA-Game.swf">http://alms.ca/wp-content/uploads/2013/09/AWQA-Game.swf</a>	NA
4	Catchment Detox (the basin challenge)	<a href="http://thebasinchallenge.com/playgame.php">http://thebasinchallenge.com/playgame.php</a>	NA
5	Cauldron	<a href="http://www.climatecentre.org/downloads/files/Case%20studies/AW_RCCC_WP8_Suarez%20and%20al%20v3.pdf">http://www.climatecentre.org/downloads/files/Case%20studies/AW_RCCC_WP8_Suarez%20and%20al%20v3.pdf</a>	Suarez, P. et al. Loss and damage in a changing climate, games for learning and dialogue that link HFA and UNFCCC. 22 (Climate center Red Cross/ Red Crescent,, The Hague, The Netherlands, 2015).
6	Contaminator	<a href="http://www.imomohub.com/?id=1-1027-1104-1106">http://www.imomohub.com/?id=1-1027-1104-1106</a>	NA
7	Darfur is dying	<a href="http://www.darfurisdying.com/">http://www.darfurisdying.com/</a>	NA
8	Fish Game	<a href="https://cloudinstitute.org/fish-game/">https://cloudinstitute.org/fish-game/</a>	NA
9	Floodsim	<a href="http://playgen.com/play/floodsim/">http://playgen.com/play/floodsim/</a>	Rebolledo-Mendez, G., Avramides, K., de Freitas, S. & Memarzia, K. in Proceedings of the 2009 ACM SIGGRAPH Symposium on Video Games 15-22 (ACM, New Orleans, Louisiana, USA, 2009). Wortley, D. in Trends and Applications of Serious Gaming and Social Media Gaming Media and Social Effects (eds Youngkyun Baek, Ryan Ko, & Tim Marsh) 1-14 (Springer, 2014).
10	Flood-WISE	<a href="http://floodwise.nl/results/the-game/">http://floodwise.nl/results/the-game/</a>	NA

Number	Game title	Links (retrieved on 27.06.2017)	Reference (if available)
11	Irrigania	<a href="http://www.geo.uzh.ch/en/units/h2k/Services/Water-Games.html">http://www.geo.uzh.ch/en/units/h2k/Services/Water-Games.html</a>	Seibert, J. & Vis, M. J. P. Irrigania – a web-based game about sharing water resources. <i>Hydrology &amp; Earth System Sciences</i> 16, 2523-2530, doi:10.5194/hess-16-2523-2012 (2012). Ewen, T. & Seibert, J. Learning about water resource sharing through game play. <i>Hydrology &amp; Earth System Sciences Discussion</i> , 1-12, doi:10.5194/hess-2016-52 (2016).
12	L' eau c' est plus qu' un jeu	Available on demand	NA
13	Lords of the valley (Floodplain Management Game)	<a href="https://crs.org.pl/en/games/lords-of-the-valley-board-game/">https://crs.org.pl/en/games/lords-of-the-valley-board-game/</a>	Stefanska, J., Magnuszewski, P., Sendzimir, J., Romaniuk, P., Taillieu, T., Dubel, A., Flachner, Z., Balogh, P., 2011. A Gaming Exercise to Explore Problem-Solving versus Relational Activities for River Floodplain Management. <i>Environmental Policy and Governance</i> 21(6) 454-471.
14	Meru	<a href="http://www.imomohub.com/?id=1-1147-1148-1150">http://www.imomohub.com/?id=1-1147-1148-1150</a>	NA
15	Mission H2O	NA (referenced on <a href="http://www.games4sustainability.org/gamespedia/mission-h2o/">http://www.games4sustainability.org/gamespedia/mission-h2o/</a> )	NA
16	Ni trop, ni trop peu, nitrogène	Personal communication	NA
17	Njoobari	<a href="https://www.commod.org/modeles/njoobari">https://www.commod.org/modeles/njoobari</a>	Barreteau, O., Bousquet, F. & Attonaty, J.-M. Role-playing games for opening the black box of multi-agent systems: method and lessons of its application to Senegal River Valley irrigated systems. <i>JASSS</i> 4 (2001).
18	NoMIX tool	<a href="http://www.novaquatis.eawag.ch/tool/nomix121e/nomix.html">http://www.novaquatis.eawag.ch/tool/nomix121e/nomix.html</a>	Pahl-Wostl, C., Schönborn, A., Willi, N., Muncke, J. & Larsen, T. A. Investigating consumer attitudes towards the new technology of urine separation. <i>Water Science and Technology</i> 48, 57-64 (2003).
19	Paying for predictions	<a href="http://www.climatecentre.org/resources-games/paying-for-predictions">http://www.climatecentre.org/resources-games/paying-for-predictions</a>	NA

Number	Game title	Links (retrieved on 27.06.2017)	Reference (if available)
20	Reef game	<a href="http://ccres.net/images/uploads/publications/1/ebm_booklet3_reefgame_ebook_lowres.pdf">http://ccres.net/images/uploads/publications/1/ebm_booklet3_reefgame_ebook_lowres.pdf</a>	Cleland, D., Dray, A., Perez, P., Cruz-Trinidad, A. & Geronimo, R. Simulating the dynamics of subsistence fishing communities REEFGAME as a learning and data-gathering computer-assisted role-play game. <i>Simulation &amp; Gaming</i> 43, 102-117, doi:10.1177/1046878110380890 (2012).
21	ReNUWIt Water/City Design Challenge	<a href="http://www.lawrencehallofscience.org/about/newsroom/in_the_news/renuwit_water_design_challenge_back_in_genuity_lab">http://www.lawrencehallofscience.org/about/newsroom/in_the_news/renuwit_water_design_challenge_back_in_genuity_lab</a>	NA
22	Run the river	<a href="https://www.mdba.gov.au/sites/default/files/runtheriver/Run_the_River.html">https://www.mdba.gov.au/sites/default/files/runtheriver/Run_the_River.html</a>	NA
23	Shumbara	<a href="http://www.imomohub.com/?id=1-1147-1148-1149">http://www.imomohub.com/?id=1-1147-1148-1149</a>	NA
24	Smarth20	<a href="http://www.smarth2o-fp7.eu/">http://www.smarth2o-fp7.eu/</a>	Rizzoli, A. E. et al. in Proceedings of the 7th International Congress on Environmental Modelling and Software. (eds D.P. Ames, N.W.T. Quinn, & A.E. Rizzoli) 1-9.
25	SOS mission eau	<a href="http://www.kezakeau.fr/enfants/sos-mission-eau">http://www.kezakeau.fr/enfants/sos-mission-eau</a>	NA
26	Stop disasters!	<a href="http://www.stopdisastersgame.org/en/playgame.html">http://www.stopdisastersgame.org/en/playgame.html</a>	Pereira, G., Prada, R. & Paiva, A. in 6th International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES) 1-8 (IEEE, Valletta, 9-12 Sept. 2014 ).
27	Sustainable delta	<a href="https://www.deltares.nl/en/software/sustainable-delta-game/">https://www.deltares.nl/en/software/sustainable-delta-game/</a>	van Pelt, S. C. et al. Communicating climate (change) uncertainties: Simulation games as boundary objects. <i>Environmental Science &amp; Policy</i> 45, 41-52, doi:http://dx.doi.org/10.1016/j.envsci.2014.09.004 (2015). van der Wal, M. M., de Kraker, J., Kroeze, C., Kirschner, P. A. & Valkering, P. Can computer models be used for social learning? A serious game in water management. <i>Environmental Modelling &amp; Software</i> 75, 119-132, doi:http://dx.doi.org/10.1016/j.envsoft.2015.10.008 (2016).



Number	Game title	Links (retrieved on 27.06.2017)	Reference (if available)
28	System_blue	<a href="https://www.shareweb.ch/site/Water/ressourcen/water-game">https://www.shareweb.ch/site/Water/ressourcen/water-game</a>	NA
29	Tip Tank, water use it wisely	<a href="http://wateruseitwisely.com/tip-tank-game/">http://wateruseitwisely.com/tip-tank-game/</a>	NA
30	The gender and climate game (2nd ed: Gender walk)	<a href="http://climatecentre.org/resources-games/the-gender-and-climate-game">http://climatecentre.org/resources-games/the-gender-and-climate-game</a>	Koelle, B. Serious Fun - Facilitating interactive games for adaptation and disaster risk reduction. 34 (Cape Town, South Africa, 2014).
31	The river Wadu role play (or the irrigation management game)	Only scientific publication	Carruthers, I. & Smith, L. The River Wadu role play — ten years experience. Irrig Drainage Syst 3, 281-308, doi:10.1007/BF01112811 (1989).
32	Thirsty for knowledge	<a href="https://www3.epa.gov/watersense/quiz/game_kids.html">https://www3.epa.gov/watersense/quiz/game_kids.html</a>	NA
33	Traveling with N on the hillslope	Personal communication	NA
34	TWIST++/ Visimple	<a href="https://www.gelsenwasser.plus/fileadmin/gelsenwasser_plus/content/vortraege_zu_tagungen/abwasser_im_gespraech_01.12.2016/03_sanierungsplanung_leicht_gemacht_20161201.pdf">https://www.gelsenwasser.plus/fileadmin/gelsenwasser_plus/content/vortraege_zu_tagungen/abwasser_im_gespraech_01.12.2016/03_sanierungsplanung_leicht_gemacht_20161201.pdf</a>	Kropp, I., Hillenbrand, T., Schwarz, D. & Sorge, C. in IWA World Water Congress & Exhibition (Lisbon, Portugal, 2014).
35	WASH game	<a href="http://www.eawag.ch/repository/sandec/washgame.html">http://www.eawag.ch/repository/sandec/washgame.html</a>	NA
36	Wat-a-game	<a href="https://sites.google.com/site/waghistoryl/">https://sites.google.com/site/waghistoryl/</a>	Ferrand, N., Farolfi, S. A., G. & du Toit, D. in ISAGA conference (ed SSAGSG) 1-16 (Singapore, 2009).
37	Water busters	NA (referenced on <a href="http://serious.gameclassification.com/EN/games/751-Water-Busters/index.html">http://serious.gameclassification.com/EN/games/751-Water-Busters/index.html</a> )	NA

## Supplementary Information

Environmental Modelling & Software

Aubert, Bauer, Lienert

Number	Game title	Links (retrieved on 27.06.2017)	Reference (if available)
38	Water coach	Only scientific publication	De Kleermaeker, S. & Arentz, L. in 9th International ISCRAM Conference. (eds L. Rothkrantz, J. Ristvej, & Z. Franco) 1-5.
39	Water life: sea turtles and the quest to nest (2nd ed)	<a href="https://games.noaa.gov/seaturtle/welcome.html">https://games.noaa.gov/seaturtle/welcome.html</a>	NA
40	Water life: where rivers meet the sea (2nd ed)	<a href="https://games.noaa.gov/oscar/welcome.html">https://games.noaa.gov/oscar/welcome.html</a>	NA
41	Water wars	Only scientific publication	Hirsch, T. in Proceedings of the 8th ACM Conference on Designing Interactive Systems 340-343 (ACM, Aarhus, Denmark, 2010).
42	Wastewater RPG	Only scientific publication	Prat, P., Aulinas, M., Turon, C., Comas, J. & Poch, M. Role playing games: a methodology to acquire knowledge for integrated wastewater infrastructures management in a river basin scale. Water Science and Technology 59, 1809-1816, doi:10.2166/wst.2009.212 (2009).
43	World Water Game	<a href="https://games4sustainability.org/gamepedia/">https://games4sustainability.org/gamepedia/</a>	NA