

PROJECT FINAL REPORT

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4.1 Final publishable summary report

4.1.1. Executive summary

SWAN (Sustainable Water Action: Building Research Links between EU and US), has been designed as a four years (2012-2016) International Cooperation Project granted by the European Commission (FP7-INCOLAB-2011), which main goal was to reinforce links between EU and US research in the field for sustainable water management. **The specificity of SWAN was to support scientific work with the implementation of an institutional innovation**, described in the Final Strategic Report submitted to the European Community in February 2016. It proposed to expand the UMI iGLOBES (CNRS/University of Arizona) into a scientific and potential training European platform in the USA for new ideas, methods and research projects at a worldwide scale. Based on the four years of experience of joint research, the main outcome of SWAN project was a feasibility study that describes the scope and the structure of a new institution: **the Institute for Open Knowledge on Water (iOKW)**. This institute will be developed on three main pillars:

- Transdisciplinary Education,
- Transdisciplinary Research
- Knowledge Exchange

The iOKW aims to function as a major international network for scientists, students and also stakeholders and communities, at both national and international level. It will be **hosted by the University of Arizona** and other local institutions involved in collaborative research initiatives, such as Pima County.

The four years of SWAN project have served to lay the foundation stones of each one of the pillars of this Institute:

- First, it has established the basis of a scientific network between the original project partners, which has been extended to the partners' collaborators.
- Second, the establishment of a Case Study in Tucson (AZ, USA) has allowed students from the partner countries to do collaborative research on water issues with the implication of local stakeholders developing thus transdisciplinary education and research.
- Third, two main actions have been already taken to make available research data to the public:
 - o the Global Climate Monitor² that is supported in the design of a data model and serves as a tool to geo-visualize global climate data and climate-environmental indicators that explain weather patterns on a global scale to any potential user, within or outside the scientific community. It therefore falls in the area of Open Knowledge, as its primary objective is to make complex data easily available;
 - o a visualization tool³ has been designed to disseminate the spatial data of the research included in the book *Water Bankruptcy in the Land Of Plenty* (a main outcome of the project that compiles the results obtained from the research conducted on the Case Study).

The open access to data is very important because the solution to environmental problems often requires data exchange at local, national and/or international level. For this reason, one of the goals of the Institute will be to generate a common database available online (from public databases that collect citizen science based studies) with access through an online portal.

² <http://www.globalclimatemonitor.org/>

³ <http://>

The specificity to the SWAN project is therefore to implement, on a scientific and an institutional level, a new model of collaborative research, taking into account the new conditions of production of knowledge and data on water and environment. It will support international activities between researchers and stakeholders, based on long-term collaborative perspective, **following the model of the Tucson Case Study** developed during the SWAN project.

Several SWAN Work Packages have contributed to this collective achievement: integration of natural and social sciences for decision-making and water sustainability (WP1), comparative perspective USA-EU (WP2), analysis of water demand (WP3) and of urban issues (WP4), feasibility study (WP5). The case study mentioned above has been an instrument to fulfill some of the objectives of these WPs; it constitutes now a model of collaborative research to be strengthened through the institutional frame provided by the iOKW.

4.1.2. Description of the project context and objectives

SWAN (Sustainable Water Action: Building Research Links between EU and US) Project, a four years International Cooperation Project granted by the European Commission (FP7-INCOLAB-2011), had as main goals to strengthen European research capacity in the USA, promote competitiveness of European research and industry while informing and involving policy-makers and the general public. The SWAN project involved five European Union Member States (Bulgaria, France, Netherlands, Spain and United Kingdom) and the USA. The European teams were The National Institute of Geophysics, Geodesy & Geography-Bulgarian Academy of Sciences (NIGGG-BAS; Bulgaria), Centre National de la Recherche Scientifique (CNRS, France), UNESCO-IHE Institute for Water Education (Netherlands), Universidad de Sevilla (USE; Spain), and University of the West of England (UWE; United Kingdom). The USA team was The University of Arizona (UA). The SWAN project was coordinated by the French CNRS that created a Joint International Research Unit (UMI 3157) in 2008, in collaboration with the University of Arizona. This Research Unit “Interdisciplinary and Global Environmental Studies” (iGLOBES) broadened its current activities from a bi-national focus to one that incorporates ideas, disciplines and methods from across Europe, including.

Opening iGLOBES to European partners (with the participation of their scholars and students) through SWAN Project responded to the need for high quality interdisciplinary and multiregional collaborations that can serve as models for research and development in diverse domains of water sustainability. These research collaboration included multi-faceted approaches that combine physical, natural, and social sciences, along with governance perspectives in the framework of an EU/USA Sustainable Water Centre (SWC), which was conceived in a Feasibility Study that fully explores how the UMI will achieve this major institutional step. During the course of the project, this final institutional arrangement was first redefined as an Organization for a Transatlantic Dialogue on Water, and as Institute for Open Knowledge on Water (iOKW) by the end of the project. This Institute will constitute a **platform that will bring together multidisciplinary research, education and knowledge exchange at both national and international levels**, taking advantage of the ‘big data’ already available and involving stakeholders during the whole process.

The SWAN work plan was organized in three phases:

1. Opening the research activities: development by the project partners European partners – scholars, students, stakeholders – of joint research activities within four work packages (see below) and achieve deliverables (reports, publications, international conferences) on resources, governance, demand and urban water in a comparative and interdisciplinary perspective and within the framework of sustainability.

2. Increase scientific cooperation: organization of three major activities - workshops, SWAN central seminar and Stakeholders Meetings – to contribute to integrate the partners and foster joint research activities.
3. Prepare for the institutional arrangement: contribution of the partners to the Feasibility Study (WP5, lead by UMI/iGLOBES) to achieve the Institute for Open Knowledge on Water and to write a research project towards this Institute.

The work was structured in major scientific transverse themes; most of them were already present in the UMI/iGLOBES thematic fields and other were identified by the partners as major areas to be studied. To optimize the cooperation among partners, the work plan was structured in seven Work Packages (WPs):

1) Water resources sustainability (WP1): led by the UA, the overall objective was to contribute to the opening of UMI/iGLOBES to both the European partners and to the project for the Institute through the deepening and expansion of the ongoing collaboration between the Hydrology and Water Resources and the Atmospheric departments of UA with the iGLOBES thematic area ‘Interdisciplinary and Global Environmental Studies’. This collaboration on water resources sustainability started in 2009 (joint publications, seminars, workshops, bilateral exchange program). For the SWAN project, the main focus was the development of a holistic and integrative approach to decision making under conditions of uncertainty and climate change, based on a coupling of the physical and social sciences. This WP was meant to facilitate a meaningful synthesis of policy-making and hydrologic modeling under climate change, combining UA expertise with that of the partner institutions.

2) EU/USA issues in water governance (WP2): led by UWE, the overall goal was to work on governance for sustainable water, with a participatory approach and to: a) develop the governance and participation studies for the project of the iOKW; b) give and organize seminar’s presentations on governance and participation; c) analyze the implementation of policies for water in selected European countries (UK, France, Spain, Netherlands and Bulgaria) and comparison with USA; d) identify Common EU/USA challenges (water quality issues); and e) prepare of material for public information and education with public, private and third sector organizations.

3) Water demand and sustainability (WP3): led by USE, the main goal of WP3 was to develop joint research within the UMI/iGLOBES in collaboration with UA and the European partners on urban water demand, water stress, drought indicators and climate change. As second objective, WP3 aimed to make a contribution among partners concerning institutional issues, dealing with water governance and the implementation of the European Water Framework Directive (WFD) as a background. The objectives aimed to contribute to the general commitments defined by the WFD (maintenance of the health of aquatic ecosystems, active participation of users in management decisions and cost recovery of water services). Furthermore, WP3 aimed to participate in the dissemination of the SWAN project activities and to promote links between knowledge and management through Spanish stakeholder participation in activities such as seminars and workshops

4) Urban water: EU/USA common models (WP4): led by CNRS, the overall objective of WP4 was to expand an integrated approach (water resources, supply, environment), one of the main thematic areas of the UMI/iGLOBES on “Interdisciplinary and Global Environmental Studies’. This area includes today current programs on “Water and urban sprawl (France/USA)”, “Water networks in the Arizona growth corridor”, and “Tools and methods for urban water management (remote sensing, DSS)” developed with the UA Hydrology and Water Resources Department and School of Natural Resources and the Environment (remote sensing program) urban and regional stakeholders). Additionally, to prepare the “urban water agenda” for iOKW was a major goal of WP4.

5) Feasibility Study (WP5): led by CNRS, the major goal of the WP5 was Final report on the Feasibility Study for the iOKW. While preparing a final report on the Feasibility study, WP5 planned to work on a list of activities and actions to be implemented to open new scientific collaborations and suggest new institutional opportunities: a) to analyze the strengths and weaknesses of the activities carried out within this project to open UMI/iGLOBES to additional European research partners; b) to assess the external opportunities and threats to this venture; c) to assist in the identification of solutions to identified problem areas in order to pave the way for smooth implementation of the envisioned consortium.

6) Management Strategy (WP6): led by CNRS, the goal was to operate to create a high degree of integration among the partners, crucial for achieving the SWAN project objectives. WP 6 aimed to ensure an efficient management structure as well as the capacity to react to any problems by establishing regular communication and meetings (physical or electronic) between all the nodes of the network, and to organize the activities to produce the three main reports leading to the iOKW.

7) Dissemination/communication (WP7): led by CNRS, WP7 aimed to disseminate information on the activities and ongoing or emerging objectives of the SWAN project to all relevant parties (European scientific community, stakeholders and policy makers, and public). By promoting the analysis and representation of approaches and tools used in the project, by preparing dissemination products and channels and by aligning the dissemination strategy with relevant EU programs and policies calendar, SWAN intended to ensure a systematic dissemination of the support actions objectives and outcomes.

Two consortium partners, BAS-NIGGG and UNESCO-IHE, did not lead any Work Package, but they have a transverse or cross-cutting role: BAS-NIGGG, Bulgaria in 'Tools and Methodologies', GIS, Remote Sensing and UNESCO-IHE in 'Education and Capacity Development'.

All the seven WPs are linked transversely by the three themes that guarantees the cross-disciplinary and multiregional intentions of the work: Climate change and uncertainty, Risks and vulnerabilities and Participation.

In summary, the **overall objectives of the SWAN consortium** were to: 1) open the activities of UMI/iGLOBES to researchers from at least 3 different Member States/Associated States other than France; 2) involve additional researchers in ongoing UMI/iGLOBES research activities, and prepare new joint projects via the organization of joint seminars, and similar activities, strengthening, thus, the scientific cooperation between EU and USA and preparing the way for a major new institutional arrangement; 3) prepare for opening UMI/iGLOBES to additional Member States/Associated States Countries through a feasibility study; 4) develop truly interdisciplinary research activities (physical, natural and social science) and integrated approach to water within the framework of sustainability; 5) establish synergistic partnerships with convergence, complementarily and effective integration of the competencies - including climate change, water demand, governance, decision making systems/sociological, and educational aspects of water management and planning; and 6) implement innovative management structures engaging stakeholders and promoting their participation: this objective has been reformulated in the project of the Institute for Open Knowledge on Water.

4.1.3. Description of the main S&T results

As described above, the work plan of SWAN project has been organized in seven work packages that covered different aspects of the research and the future institutional arrangements for the iOKW. Therefore, below there are described the main results following in Work Packages.

4.1.3.1. Water resources sustainability (WP1)

The main goals of WP1 were to:

- a) Develop a holistic and integrative approach to decision making under conditions of uncertainty and climate change, based on a coupling of the physical and social sciences.
- b) Facilitate a meaningful synthesis of policy-making and hydrologic modeling under climate change, by combining UA expertise with that of the partner institutions.

WP1 was developed and executed by the USA contingent of the SWAN Project team, based at the University of Arizona. Being where the host organization (the CNRS Joint International Research Unit (UMI 3157) the coordinating unit) is based, the USA team was also heavily involved in administrative and organizational activities throughout the project. For example, it served as the host for students from partner institutions to visit and collaborate together, organized and ran the central seminar, conceived of and helped manage the TAMA study, coordinated and held stakeholder interactions and meetings, and organized, hosted and ran the final SWAN International Conference in Tucson, and hosted and ran a student workshop on Transdisciplinarity in Scientific Education.

The research activities of WP1 (Water resources sustainability) focused on and addressed all three of the main SWAN focus areas (Climate change and uncertainty, Risks and vulnerabilities, and Water demand and sustainability). In addition it contributed to WP2 (Issues in Water Governance) through a paper produced by a visiting Brazilian student, to WP4 (Urban water: EU/USA common models) through our Urban Center focused climate modeling studies, to WP5 and WP6 (Feasibility study & Management strategy) through idea development, and to WP7 (Dissemination/communication) through editing and preparing a joint book (“Water Bankruptcy in the land of plenty”; Deliverable 4.2), publishing papers, making professional presentations, hosting visitors, and organizing conferences and conference sessions).

Primary Research Focus & Approach: The main research focus of WP1 was an intensive modeling study to evaluate the changes in regional climate that could arise due to projected urbanization in the Phoenix-Tucson corridor, Arizona. For this, it applied the WRF-NOAH regional land-atmosphere model coupled to a detailed urban radiation scheme over the region. Land use and land cover change (LULCC) associated with urban expansion are expected to alter the surface albedo, heat capacity, and thermal conductivity of the surface, making the energy balance in urban regions different from that of natural surfaces. In our study, land cover changes were represented using land cover data for 2005 and projections to 2050, and historical North American Regional Reanalysis (NARR) data were used to specify the lateral boundary conditions.

Primary Research Achievements:

- 1) The investigation was completed. The results indicate that **temperature changes can be expected to be well defined, reflecting the urban heat island (UHI) effect within areas experiencing LULCC**. However, it is not clear whether changes in precipitation can be expected; the results do seem to indicate **reductions in precipitation over the mountainous regions northeast of Phoenix and decreased evening precipitation over the urbanizing area**, but cannot be considered statistically robust.
- 2) The results were published in a peer-reviewed manuscript entitled “*Urban Effects on Regional climate: A Case Study in the Phoenix and Tucson ‘Sun’ Corridor*” by Yang Z, F Dominguez, HV Gupta, X Zeng, L Norman (In press, accepted October 2015) in a Special Issue on “Biogeophysical Climatic Impacts of LULCC” of Earth Interactions (doi:10.1175/EI-D-15-0027.1); available online at:
- 3) <http://journals.ametsoc.org/doi/abs/10.1175/EI-D-15-0027.1>, in ‘Early online Releases’.

- 4) A chapter entitled “*Potential Impacts of the developing Phoenix-Tucson ‘Sun’ Corridor on Regional Climate*” by Yang Z, F Dominguez, H Gupta, X Zeng and L Norman was included in the SWAN book entitled “*Water Bankruptcy In The Land Of Plenty: Steps towards a transatlantic and transdisciplinary assessment on the nature and causes of water scarcity in Southern Arizona*” edited by Gupta HV, F Poupeau, MA Sans-Fuentes & A Serrat-Capdevilla, CRC Press.
- 5) *The modeling study work forms the PhD Dissertation of Mr. Zhao Yang tentatively titled “Potential Impacts of Urbanization and Agriculture on Regional Climate.*
- 6) Based on this work, Mr. Zhao Yang was awarded the 2015 Montgomery Prize (\$2000) for Best Oral Presentation Award, for his talk entitled *Urban effects on regional climate: A case study in the Phoenix-Tucson Corridor*, at the El Dia Del Agua conference at the University of Arizona in April.
- 7) To complement the “urbanization-focused” study, a new avenue of research was initiated to evaluate the effects of irrigation in the California Central Valley on the local and non-local climate. As part of that work, we are quantifying how much water leaves the region (after evaporating from agricultural land) and is transported to other regions to later fall again as rain.
- 8) With regards to (6) above, we are currently preparing a manuscript “*Model Irrigation Impact and Water Vapor Transport of the California Central Valley with the Regional Climate Model WRF Coupled with Realistic Irrigation and a Water Vapor Transport Scheme*” by Yang Z, F Dominguez, and X Zeng.
- 9) In related work, the UA team collaborated with the BAS-NIGGG team to quantification ecosystem services provide by the Upper Santa Cruz watershed using the SWAT hydrological model.

Other Achievements: WP1 has played a key role in integrating the efforts of our various partners. The following activities have been key:

1- Central Seminar Series: Since 2014, the US team hosted the SWAN Central Seminar Series, with assistance from the CNRS-UMI team. The Central Seminar was a series of talks promoting hydrological science, issues having to do with water policy and decision-making, and issues to do with bridging the social and physical sciences.

2- SWAN International Conference: “*Open Knowledge: Bridging Perspectives to Address Water Challenges*”. The UA team organized and hosted the SWAN International Conference (February 16-17, 2016), with assistance from the CNRS-UMI team. Faculty from the UA participated on the Local Organizing Committee (including from the Institute of the Environment, Hydrology Department, and Atmospheric Sciences Department). About 100 people participated. The meeting consisted of both presentations and breakout workshop style discussions aimed at development of several white papers in regards to transdisciplinary science. The US team also organized one of the major sessions, focused in Climate Change Impacts.

3- SWAN Student Workshop: “*Can we Talk? Designing a Transdisciplinary Education Experience*”. The UA team organized and hosted a one-day Student-Only Workshop at the Biosphere 2 facilities (February 15, 2016). The main focus was the development of guidelines for improved transdisciplinary education. The conclusions of this Workshop were presented during the Session 3 of the SWAN International Conference. In preparation, the team of about 25 students (including both SWAN and non-SWAN students) met regularly (by remote access) throughout the period

September-January to discuss the subject matter and develop recommendations. These recommendations will be developed into a white paper on transdisciplinary education.

4- Participatory Planning Process. The US team collaborated with the CNRS-UMI team and other partners to develop a participatory planning process that combines integrative modeling with a process for structured stakeholder participation to facilitate decision-makers and affected parties to arrive at a common definition of relevant problems, scenarios and management alternatives. Several stakeholders were engaged in the collaborative discussion and elaboration of different management alternatives and strategies to cope with future changes in the relationships between water demand and availability. A case study was developed to investigate the extent to which scientists participate in and scientific research is used in state water management legislation proposed and passed in the past ten years.

5- Investigation into the Impacts of Science Decision Making: MS student Ms. Susan Ward Harris conducted an investigation of the extent to which scientists have participated in and scientific research has been used in Arizona state water management legislation proposed and passed during the past ten years. After reviewing the relevant literature, Ms. Harris conducted interviews & meetings with various project stakeholders. The results were reported in a book chapter entitled “*Differentiated approaches of groundwater management: A comparison between the TAMA and the San Pedro basin*” in the SWAN book “*Water Bankruptcy In The Land Of Plenty: Steps towards a transatlantic and transdisciplinary assessment on the nature and causes of water scarcity in Southern Arizona*”. A draft manuscript “*Do Scientists Want a Place at the Table? The development and evolution of Post-Normal Science*” by Harris, SW, HV Gupta, F Poupeau (intended for peer-review publication) is under preparation.

6- Development of the Tucson Basin Case Study. The US team collaborated with the CNRS-UMI team, other SWAN partners, and several local stakeholders in the development of the Tucson Basin Case Study as a focus for collaborative investigation. The collaboration resulted in several chapters in the in the SWAN book “*Water Bankruptcy In The Land Of Plenty: Steps towards a transatlantic and transdisciplinary assessment on the nature and causes of water scarcity in Southern Arizona*”.

4.1.3.2. EU/USA issues in water governance (WP2)

University of the West of England (UWE) (Partner 3) led on Work Package 2 ‘**EU/USA Issues in Water Governance**’ with the overall objective to undertake a four year study of the development and implementation of policies related to sustainable water in the UK, France, Spain, The Netherlands and Bulgaria, and comparison of these experiences initiatives in the USA. We organized this around the comparative study of responses in specific states/member nations to common water security challenges.

Specific objectives of the research include:

- To develop a methodology for the comparative study of water security/sustainability policies and institutions.
- To initiate detailed case studies of water security/sustainability policies in a selection of catchments or “urban hydro-social regions” within the UK, Spain, The Netherlands, France, Bulgaria and the USA.
- To focus on a very small number of specific water quality issues with a view to studying their constitution as ‘problems’ and the range of subsequent management options.

- To prepare technical reports and academic papers describing and analyzing comparative experience in policymaking and implementation for water security/sustainable water.
- To provide for PhD level study of some appropriate aspect of this overall work package – this was resolved in 2013 with the recruitment of Owen KING to undertake a PhD level student of the role of “water issues” in the permitting process for a new copper mine and smelter proposed for southern Arizona.
- To organize collaboration and dissemination events, including collaborative working group meetings (as agreed amongst the INCO-LAB team) and a public conference linked specifically to the work package proposed here.

The three specific tasks created to achieve these goals were:

- **Task 2.1: Public Participation in Water Management Decisions: EU/US [M1-M6];** carried out by UWE, in collaboration with UMI, US, and UNESCO-IHE.

Description: Thinking about the realities of, and mechanisms for, encouragement of broader public participation in water decision-making is a key task of the UWE, Bristol team. Getting beyond idealistic prescriptions of “more democracy”, the objective is to better understand the realities of public participation processes and innovative mechanisms for promotion of same.

Achievements: Working with the UWE SWAN Research Associate Lorraine De Souza and PG students Staddon has undertaken a careful reconsideration of the “public participation” element of the IWRM water management paradigm, resulting in a number of short papers describing different dimensions of consensus and dissensus in participatory processes, and their implications for more open democratic decision making. Alongside this process we have completed short technical reviews of the consultations process attendant on a signal piece of UK water legislation, the 2014 *Water Act* and the use of social media (especially Twitter) by water companies for customer engagement.

Outputs related to the task:

- 1- Continuation of Participant Observation Study of “Customer Challenge Group” Process in English Water Sector: this process has been underway since January 2012 and involves an empanelled group of “citizens” who are customers of English water companies iteratively scrutinizing water company business plans, leading towards a socially-legitimated business plan, including capex and opex plans, for March 2015. In November 2015 Staddon’s involvement with this group was renewed for the next Business Planning cycle.
 - 2- A Handbook of papers related to SWAN-supported work on Stakeholder Engagement was completed during February 2016. As noted above, this handbook also reflects back on the paradigmatic participatory principle embedded within IWRM and the EC Water Framework Directive (2000).
 - 3- Publishers have expressed interest in developing the deliverable as a commercial academic publication. Contracts were concluded during Spring 2016.
- **Task 2.2: Develop a comparative framework for water security policies: a key thematic field for EU/US [M6-M24];** carried out by UWE in collaboration with UMI, US, UNESCO-IHE.

Description: This task has, to date, resulted in a Working Paper within the UWE-SWAN Working Paper series (see *Additional relevant activities of the UWE-SWAN section and SWAN website*), a published version of the same paper and the commitment of UWE and other external resources towards separate but aligned exploration of the “water security” concept. Building on work already underway, including but not limited to SWAN, the overall aims of this new linked project, funded by the Lloyd’s Register Foundation, are threefold:

- a. To continue the long-term process of building a world class science base for issues related to water security including transboundary water governance, public participation, water sensitive urban design, water quality management, socio-legal innovations, public and popular education, etc.
- b. To foster stronger links between and among consortium members, who are already recognized as regional centers of excellence in various aspects of water management.
- c. To train up a cadre of approximately 20 new postgraduates with specialisms in key areas of water security

***Achievements:** Participants in both projects share information through attendance at joint seminars through to SWAN’s conclusion in February 2016. This task has also been developed considerably beyond the 2013 publications noted in earlier reports with the establishment of a strong web platform for organising and disseminating water security related communications and research outputs (www.watersecuritynetwork.org). Over the course of this reporting period we have also organised two international conferences exploring dimensions of Water Security, largely funded from outside SWAN, the most high profile held in conjunction with the International Water Resources Association (IWRA) meetings in Edinburgh, Scotland in May 2015. This conference session will form part of a special issue of the IWRA journal *Water International*, in 2017.*

- **Task 2.3: Joint research activities: WFD (Water Framework directive).** [M18-M45]; carried out by UWE in collaboration with US and UNESCO-IHE.

Description: Joint research activities: the WFD (Water Framework Directive). This task involved coordination of joint research (researchers and students) with UMI, UWE, US and UNESCO-IHE the contribution to the seminar and workshops. These activities encompassed institutional issues dealing with water governance and the implementation of the European Water Framework Directive (WFD).

Achievements: the WFD process entered a new phase with EU members’ River Basin Districts beginning the process of revising their Management Plans, originally submitted to the Commission in late 2009. Our work under this agreed Task has been to monitor changes to the Severn RBDMP applied during the revision process. Currently the revised Severn RBDMP is, along with all other RBDMPs in England and Wales, being consulted upon through a process managed by the Environment Agency. A consultation on the draft proposed updates to RBMPs was open from October 2014 to April 2015.

- **Additional Task 2.4: Joint research activities: Sustainable Water as a “Hydrosocial Construct”**

Description: Urban governance is as much as about infrastructure as it is about people and processes. In particular, the history of urban governance is closely intertwined with the history of urban water services. As urban areas became larger and more densely inhabited, the collective need for better water services (drinking water, sanitation and flood protection in

particular) became overwhelming. Cities simply could not grow beyond a certain relatively modest size without the simultaneous articulation of an integrated water services infrastructure to replace the piecemeal local arrangements then in place. This necessarily implied new and more complex governance arrangements, in this case the institutionalisation of water services management in functional departmental structures, with linked to political decision-making, finance, quality assurance and related functions. Whilst others have presented case studies of the urban hydrosocial transition (UHT) in terms of the physical extension of water services (e.g. water supply, sanitation and surface water management), this work focuses on specifically *urban* governance of water. We argue that the progressive breakdown of Fordist neo-corporatism in water services has opened up the field to a proliferation of “glocal” (to use Swyngedouw’s useful neologism) governance arrangements. Whilst integrated water resource management (IWRM) principles imply a supra-urban scale of governance, the fact that urbanisation brings with it local concentration of water-related impacts means that there is an ineluctable local and urban dimension to water governance. It is therefore not surprising that cities around the world are asserting themselves as central players in water governance.

***Achievements:** This additional task is being developed generally through postgraduate research students (especially King) and associated team members (especially Burton, Newman and Staddon) and through progressive workshops on “integrative (socio-natural scientific) modeling”, “urban hydrosocial transition” and science communication with other SWAN colleague. Burton (with Richard Newman) organized a one-day workshop on Urban Water and has gained funding (as a Co-I) on an ESRC funded Seminar Series on Extreme weather governance and participation (to start later in 2016). Specifically, case studies of water as a “hydrosocial construct” are developed:*

- *Case study 1: PES trials in Upper Thames Catchment*
- *Case study 2: Environmental adaptation and hydro-conflict at the subnational scale*
- *Case study 3: Managing, preparing, and attending to drought/flood waters*
- *Case study 4: The Hydrosocial Transition in European and International Comparative Context*
- *Case Study 5: Social Construction of Opposition to Shale Gas (Fracking) in the UK*

A further bundle of city case studies of “urban hydrosocial transition” are being prepared, the first tranche having been published in late 2014 and early 2015

In addition to all of the above, the UWE team developed two deliverables for WP2:

D.2.1 is a **working paper on “Water Security and sustainability”**; this is a contribution to the Mid Term Consortium Report: “Building integrated water research for sustainability”

Deliverable 2.1: has been achieved during the period: Staddon C., James N. “Water Security: genealogy of a new paradigm” paper presented to SWAN team in autumn 2013 and published in early 2014. Associated papers have also published on the SWAN website. In May 2015 Staddon co-convoked sessions on “water security” at the meetings of the International Water Resources Association in Edinburgh, Scotland.

D.2.2 Handbook: “Stakeholders Workshops”

Deliverable 2.2: was delivered in February 2016. A copy of the *Stakeholder Handbook* was lodged with the Commission earlier in 2016.

The *Handbook* reflects back on the paradigmatic participatory principle embedded within integrated water resource management. A key element of sustainable and secure water is “participation”. As Owen King (whose PhD was funded through SWAN) points out, participation has since at least the 1992 Dublin Principles been placed at the centre of the desired governance approaches. But what is “participation”, how can it be achieved and what happens when it goes wrong? These are questions addressed by the 8 chapters in this Handbook. Each of the chapters approaches “participation” in a different way: sometimes theoretically (e.g. Chapters 2 and 3), sometimes formally (e.g. Chapter 4, 5 and 9) and sometimes in terms what happens when things go wrong (e.g. Chapter 7).

Chapter 8 is somewhat different, presenting summary results from a workshop held in Bristol in July 2015 on the subject of “Reimagining Urban Water”. Here invited stakeholders affirmed the critical importance of participation as crucial for creating such social innovations at the local level. They acknowledged that a barrier to making change at local level is the ability to engage people in debates and action about water management. The perception was that most people don’t think about urban water management until there is a problem – scarcity or excess – at which point the participation of people is likely to become focussed upon quick fix solutions to the immediate issues.

This is precisely the challenge of stakeholder engagement – how can we theorise, organise and implement stakeholder engagement in water management decision-making so that our engagement becomes about celebrating and disseminating success rather than merely replicating the weary round of “learning the lessons” when things go wrong? The chapters in this handbook begin to show the way forward.

4.1.3.3. Water demand and sustainability (WP3)

The University of Seville team led Work Package 3 *Water Demand and Sustainability* with substantial input from partners 1 (climate change/risks), 2 (urban water), 3 (governance) and 5 (BAS-NIGGG). The *overall objective* of WP3 was to develop joint research with UMI in collaboration with UA and the European partners about urban water demand, water stress, drought indicators and climate change. A second general objective was to make a contribution among partners concerning institutional issues, dealing with water governance and implementation of the European Water Framework Directive (WFD) as a background. The *specific objectives* include exchanging knowledge and building cooperation among partners on: socio-hydrological urban water cycle governance; useful instruments for improving water resources management in urban areas; climate change simulation models applied to study the effects of scenarios on urban water demand; and work on the debates and implications of WFD general goals, methodological advances and socio-institutional experiences.

Four *specific tasks* were originally planned to achieve these objectives:

Task 3.1: Preparation and realization of research stays at UMI.

Description: Integration of research team and students with the UMI and UA research activities in the different areas of scientific cooperation. Initial focus on domestic water demand explanation factors was expanded throughout the project to incorporate other scientific areas of concern as developed in the context of emerging concepts and ideas for the Transatlantic Water Dialogue Network (TWDN). More concretely, the research stays of various USE PhD students at the University of Arizona over the past 4 years evolved into a transdisciplinary research project focused on the Tucson basin.

Achievements: Networking, collaboration and the development of mutual learning opportunities were essential aspects of the SWAN project. This approach was reinforced through regular project meetings and the promotion of research stays at the University of Arizona.

Task 3.2: Developing web tools for sustainability; carried out by USE (partner 4) in collaboration with partners 1, 2 and 5. Task 3-2 was closely related with the scientific work necessary for Deliverable 3.1: "Key water data for water resources planning and risks", one of the two key scientific outputs of the University of Seville within the SWAN project. The identification of key data for water resource and risk management is an important contribution of the SWAN project. At the same time, one of the defining factors of the SWAN scientific approach in general, and of the work of the University of Seville team in particular, is the collaboration with stakeholders and regional and local actors.

Consistently with this participatory and collaborative scientific approach, the USE team organized in January 2013 at the University of Seville the ***Workshop on New paradigms in water resources and risk management: Key water data and information for sustainability***. Over 50 experts including representatives of regional, local and water administrations, environmental groups, university researchers, water managers and other stakeholders were invited to participate and contribute their ideas and expertise. The workshop was organized around five topics of particular relevance for the goals of the activity, with a keynote presentation by Spanish experts on the different topics, followed by debate with workshop participants (see <http://swanproject.webhost.uits.arizona.edu/swan-workshop-university-seville-february-25-2013>)

Building on the results of the Workshop, the USE SWAN team, in collaboration with other members of the SWAN partnership organized the ***International Conference on Data, Information and Knowledge for Water Governance in the Networked Society***, at the University of Seville, June 9-11 2014. The goal of the Conference was to analyze the current debates and innovations on the issues surrounding the collaborative generation, processing and dissemination of data, information and knowledge for the management of natural resources in general and water resources in particular. The Conference was organized around four thematic sessions. The first two were highly theoretical and reflexive, while the last two aimed to present innovative practices and real operational-technological applications in the world of collaborative information for natural resources management, always within a relevant theoretical framework. Video recordings of all the sessions as well as the supporting materials for each presentation can be found at: <https://swanproject.arizona.edu/international-conferences>.

Task 3.3: Participation in joint research activities. A central component and characteristic of SWAN is the development of collaborative research initiatives between SWAN partners and gradually extend these collaborative efforts to other potential partners of the future Sustainable Water Center. Specific initiatives include:

1. **Collaboration with WP1: Applicability of the IESP drought index to areas with scarce precipitation and runoff data.** The University of Seville has developed the IESP drought index which is widely used by public administrations in Andalusia and other Spanish research groups as an alternative to other drought indicators. UA (Partner 2) is working on drought risk management in different locations in Africa where data on rainfall and runoff is scarce and often unreliable. After Prof. Camarillo's research stay in Tucson in November 2012, a collaborative effort developed to prospectively analyze the possibility of applying the IESP index to regions with scarce rainfall data, specifically to rainfall in Africa. This work developed during the second reporting period, particularly in the research stay of Dr. Natalia Limones at UA in Tucson in January-April 2014 and October-November 2014.

2. **Collaboration with WP2 on the “Evaluation of the WFD implementation process”.** Doctoral candidates were hired by USE and UWE to collaborate on this issue. As a result of the discussions on common approaches and research focus, USE participated in a Special session convened by SWAN UWE team at the Annual International Conference of the British Royal Geographical Society celebrated in London in August 2013 presenting their work particularly in what pertains to the use of economic instruments in general and water markets in particular and its applicability to British water policy reform proposals currently under debate and approval process. A specific WFD evaluation workshop was organized in the framework of the 4th SWAN Progress Meeting with participation of stakeholders from Spain, the Netherlands, Bulgaria and the UK. Finally, three papers have been published in three different scientific journals dealing with the three proposed topics for the USE work on this issue and that will be part of a Doctoral Dissertation by USE PhD candidate Nuria Hernández-Mora.

3. **Development of the Tucson Basin Case Study**, the key collaborative research effort involving all SWAN project partners and several local stakeholders. USE researchers participate actively in this effort. Specifically:
 - Active participation in the weekly SWAN project meetings in the spring of 2014.
 - **Jumpstarting the work with stakeholders in the Tucson Basin Case Study.** In November 2013 and in the context of SWAN's 3rd Progress Meeting held at the University of Arizona in Tucson, Nuria Hernández-Mora and Violeta Cabello (University of Seville) collaborated with Dr. Aleix Serrat-Capdevila in the organization of a Stakeholder workshop to identify research priorities for the Tucson Basin Case Study.
 - Active participation in the Tucson Basin Case Study workshop celebrated in the context of the 4th, 5th and 6th SWAN progress meetings and in the weekly SWAN Project meetings.

4. **Contribution to SWAN book "Water Bankruptcy"** that includes chapters on the Tucson basin case study by different USE researchers, including:
 - Water use and banking in the Tucson basin: Implications of a spatially neutral groundwater management. Violeta Cabello, Nuria Hernández-Mora, Aleix Serrat-Capdevila, Ed Curley and Leandro del Moral.
 - Tucson GW dynamics. How is it affected by natural drought? Natalia Limones
 - Urban comprehensive planning. Evaluation and monitoring mechanisms for Tucson Plan. Specially related to water in the context of SWAN project - Tucson Basin Case Study. Sergio Segura-Calero and Belén Pedregal-Mateos

5. **Active participation in weekly SWAN project meetings.** The weekly meetings became a focal point of research collaboration between UofA SWAN professors and researchers, UMI researchers, and visiting scholars from SWAN partners (Bulgaria and Spain) and other PhD students from other universities. These meetings were instrumental in several ways. They served to strengthen the collaborative efforts between SWAN partners and building research networks with other potential partners; helped build the theoretical framework for a common interdisciplinary case study in Arizona for all SWAN visiting students and scholars that served as the basis for scientific collaboration; and served to conduct the Central Seminar of the SWAN project with talks and presentations from different Arizona stakeholders, managers and SWAN researchers. Members of the USE team in Spain connect remotely via Skype or GotoMeeting technology.

Task 3.4. Dissemination of the activities of feasibility study and results and joint publications.

A key component of the USE team's work and of SWAN more generally, is the dissemination of results of collaborative work, and the building of collaborative networks with public administrations, other research institutions and local, regional and national stakeholders. In this respect, and in addition to multiple academic publications that are included in other sections of this report, the USE team has conducted the following activities:

1. Developed the **USE SWAN eNewsletter** to present the progress made by the USE team in the context of the SWAN project. Three issues were published (April 2013, October 2013 and September 2014). The electronic newsletter was widely distributed and is currently available in the SWAN project website: <https://swanproject.webhost.uits.arizona.edu/news/newsletter-university-seville%E2%80%99-swan-team>
2. The USE team relied on ICT tools to disseminate the results of its activities:
 - Made workshop and International Conference materials available at the USE website: <http://grupo.us.es/giest/es/node/856> and the SWAN website.
 - The USE funded the online streaming of the Conference through the University of Seville's video streaming service.
 - We also launched a twitter account **@waterP2P** in order to disseminate conference results and serve as a node for discussions about these topics on twitter.
 - The contents of the International Conference (presentations and video recordings) are available at the SWAN project and USE GIEST research group websites: <http://swanproject.webhost.uits.arizona.edu/> and <http://grupo.us.es/giest/es/node/856> respectively..
3. **Submitted a Spanish version of the extended conclusions of the January workshop** for publication to the periodic journal of the Spanish Association of Geographers (<http://www.boletinage.com/>).
4. **Special Issue on Data, Information and Knowledge for Water Alternatives and other dissemination activities.** Complementing the organization of the International Conference, the USE SWAN team launched and published a special issue on *Information and Knowledge for Water Governance in the Networked Society* in July 2015 in the international journal *Water Alternatives* (<http://www.water-alternatives.org/index.php/current-issue/1888-articles-toc/vol8/289-issue8-2>).
5. **Developed geovisualization tools to disseminate the results of SWAN project** in close collaboration with beneficiaries 1 (CNRS) and 5 (National Institute of Geophysics Geodesy and Geography - Bulgarian Academy of Sciences. Specifically:
 - **Implementation of a Global Climate and Water Monitor: Conveying Knowledge from Data.** *Members of the University of Seville SWAN Team's Climate Division Natalia Limones and Juanma Camarillo presented a global climate web viewer that contains information from 1901 to the present at a monthly time scale and with a resolution of half a degree of latitude and longitude. Several indicators from the Climate Research Unit (CRU-University of East Anglia) time series were generated, in addition to many others which are in continuous development, and are displayed along with the original climatic variables, conveying some information of extraordinary value which is not sufficiently exploited and*

accessible to the public. The Global Climate Monitor was launched to the public as an open data tool in June 2014 and is accessible at: www.globalclimatemonitor.org

- **Development of a visualization tool for the Tucson Basin case study results.** The USE team worked in collaboration with the BAS-NIGGG team on the conceptual and functional development of the tool, as well as the development of the interoperativity services of the maps (WMS) in relation to those layers with geographic information that have been produced by different SWAN partners for the TAMA case study. The visor is available at: www.gis-swan.org.

In addition to these specific activities, USE team developed two DELIVERABLES:

Deliverable 3.1: " Key Data and Information Requirements in the Context of Current Debates on Water Management," April 2014. Deliverable 3.1 was based on the discussions of the Workshop on *New paradigms in water resources and risks management: Key water data and information for sustainability*, organized by the USE SWAN Team on January 25, 2013. Preliminary conclusions were discussed and enriched with contributions from seminar participants and other SWAN team members (particularly Beneficiaries 1 and 5) and are available as a Technical Report submitted to the European Commission entitled Key Data and Information Requirements in the Context of Current Debates on Water Management. **Deliverable 3.2 "Evaluation of the WFD implementation process in Europe"** (planned for M36) was submitted to the Commission in August 2015 (Month 40). The delay was necessary in order to incorporate the results of the 4th European Water Conference, which was held in Brussels in April 2015. The conference served to review the implementation of the Water Framework and Floods Directives and its outputs were incorporated into D 3.2.

4.1.3.4. Urban water: EU/USA common models (WP4)

The WP4 has successfully achieved its objectives to expand one of the main existing thematic areas of UMI 3157 an “urban + water” integrated approach (from water resources to water supply and sanitation, and the environment), with the achievement of its specific objectives of:

- (1) Developing an urban water integrated approach that would be used throughout the SWAN project;
- (2) Identifying key scientific or technological problems relevant to the field of urban water and evaluate existing capacities within this thematic area and identifying gaps.

The team of WP4 has had an essential key role in designing, implementing and coordinating efforts from the multiple research lines by all project partners, crystallizing around the Tucson Case Study with the published book “Water Bankruptcy in the Land of Plenty”.

The development of an urban water integrated approach that would be used throughout the SWAN project took place during the first months of the project, learning about each partner’s work. During the spring of 2013, a cooperative approach was developed, oriented towards trans-disciplinary research. The initial discussions focused on establishing strong connections among the different disciplines represented, the development of a holistic vision of water-related research, and a search for common frames of analysis. These discussions resulted in an integrated proposal for project integration, setting the foundation for our on-going collaborative engagement. The practice of weekly student/researcher meetings was unanimously institutionalized as a concrete means to

advance scientific cooperation. A methodological white paper was collaboratively written to connect the variety of scientific disciplines, analytical frameworks, and models of understanding, thereby providing a practical mechanism for trans-disciplinary collaboration (Serrat-Capdevila, Cabello, Boyanova, Poupeau et al).

Within this framework, it became apparent that a ‘place-based’ case study would provide the vehicle for moving from the abstract to the specific, focusing and integrating all research efforts in the Tucson Case Study (**Task 4.1** – theoretical, methodological, and practical case study). The setting of the Tucson Basin presented us with a unique combination of characteristics: a specific ecological system, a history and a strong know-how in terms of water management technologies and institutions, a very organized water community with public debates and information meetings, and a long-standing tradition of collaboration between institutions, research centres and professional associations.

To accomplish the second objective (*Identifying key scientific or technological problems relevant to the field of urban water, capacities, gaps*) the SWAN team drew upon the critique of positivist science and the development of the Post-Normal Science approach (Funtowitz & Ravetz, 1994) as a guide for the development of collaborative relationships with the local stakeholders. This approach emphasizes the uncertainty of model predictions and the incommensurability of complex issues due to differences in stakeholder values and perceptions, and deems the involvement of non-academics to be essential in the definition of the research problems and in the collaborative research process. The SWAN team in Tucson progressively developed congenial relationships with a number of local water managers and stakeholders, thereby establishing an essential basis for this research. Many of these persons were invited to participate in one or more of the weekly meetings, to present seminars, and to engage in discussions of how the research being conducted by scientists could be made more relevant to the water challenges faced by the Tucson Basin. This dialogue led to the formulation of several research questions, and several working sessions and workshops with local stakeholder experts and members of the broader academic water community in Tucson during the project. Thanks to these interactions, several goals were accomplished: (a) Identification of key management challenges in the Tucson basin region; (b) Evaluation and prioritization of pre-defined research questions; (c) Identification of knowledge gaps and proposal of new research questions, which set the stage for many of the research lines within the project; (d) An initial map of relevant regional stakeholders, (e) A system of pairing partner researchers with relevant practitioners and resource persons; (f) An open dialogue as research lines evolved, ensuring a feedback loop between researchers and practitioners; and (g) A successful final Water Management Session in the closure of the project with a large number of attending stakeholders (~25) and an open roadmap for future collaboration.

A key feature of this dialogue within the project is that it enabled extensive and ongoing conversations with a set of very knowledgeable and experienced stakeholders, and facilitated an in-depth exchange of ideas, and resulting in a rich and productive research experience. These numerous ongoing dialogues with varied stakeholder agencies represent the achievement of **Task 4.3**, with the final water management session in the SWAN final conference and its break-out discussion groups marking the culmination of the SWAN stakeholder workshops. Numerous participating stakeholders deemed the session and the discussion working groups extremely informative and well facilitated, bringing together many topics and breaking disciplinary and sectoral barriers.

The integrated approach developed within the SWAN project and its application in the Tucson Case Study with its very real and specific water resources management context, with its agencies and actors, illustrates how human water use, planning and management are related to specific components and footprints of the water budget, to ecosystem functions, to changes in climate, land use and social parameters, and to environmental impacts. The coupling of human-centric and

physical-centric approaches in the Tucson Case Study enables the analysis of feedbacks and linkages between fields of research that have been largely disconnected. This methodological integration and its application in the Tucson region in collaboration with water practitioners represents the core of the research developed within the SWAN project (and chapters in the abovementioned book), focusing on specific transdisciplinary research questions tied to the Tucson Basin and its stakeholders. In parallel, a geo-spatial database and visualization tools has been developed, representing a repository of relevant spatial and geo-referenced data of the research carried out within the SWAN project (achieving **Task 4.2**).

The work developed within the SWAN Project has already been of interest and benefit to the stakeholder community by illustrating key issues regarding the relationship between urban growth, land use, drought, ecosystem services, biodiversity, green infrastructure, water source development and reuse, policy and planning. The findings of this research are especially relevant in the current context of potential shortages in the Colorado River, drought and the uncertainties arising from climate and global change. Acknowledging the need for an evolving science with new schools of thought to analyse environmental issues, the work accomplished here is an effort to provide an integrative analysis to keep up with observed growing levels of complexity in social-ecological dynamics. More effective strategies are needed to deal with present and soon to come human-ecological problems.

4.1.3.5. Feasibility Study (WP5)

Led by UMI (CNRS) with collaboration of all partners, WP5 has achieved a final report on the Feasibility study in order to implement new scientific collaborations and suggest new institutional opportunities. The general objective was to analyze the strengths and weaknesses of the activities carried out within this project to open the UMI based in the University of Arizona to additional European research partners; and to assess the opportunities to implement a new institutional structure supporting international collaboration between the EU and the US. The specific objectives were to realize a risk analysis assessment, to build a socio-economic report and to involve a Stakeholders Committee that would contribute to produce strategic scientific orientations, suggest new institutional opportunities and link the SWAN activities with on-going and future European policies. The three tasks to achieve these goals were realized on time:

- **Task 5-1: Guidance and acceptance to prepare the Feasibility Study**, has been carried by the CNRS in the Deliverable 5.1 (Period 1).
- **Task 5-2: Risk Assessment Analysis** has been carried by the Legal Services (DAJ) of the CNRS in Paris in the Deliverable 5.3 (Period 2) and has been augmented by a Socio-Economic Action Plan (Deliverable 6.5, Period 3).
- **Task 5-3: Final Report on the Feasibility Study** (Deliverable 6.6, Period 3) is carried by the CNRS in collaboration with all the other partners. Three other deliverables of **Stakeholders' Committee Recommendations for building the Feasibility Study** (D. 5.2, 5.4, 5.5) were planned to prepare the **Final report on the new institutional arrangement (D. 5.6)** that had to be included in **the Final Report of the SWAN project (D. 6.6)**.

One of the main outcomes of the SWAN project is the differentiation of stakeholders in three levels of action and collaboration:

- Level 1: International Stakeholders Advisory Board for the SWAN feasibility study. Its role is to provide advice and insights on how academia and managers can work together to better inform management challenges and relevant research.

- Level 2: National Stakeholders that regularly collaborate with the corresponding participating teams in the SWAN project, collaborating in their ordinary activities of research and dissemination, even outside of SWAN.
- Level 3: Local Stakeholders that are involved in each case study and work together with the researchers.

A survey was realized to realize a comparison of stakeholder challenges across Europe and America, and to share best practice or researching solutions together through a transatlantic dialogue. The results of the survey, described in Deliverables 5.4 and 5.5, gave significant insight to the involvement of stakeholders to the case study and to a collaborative research process. Stakeholders wish to collaborate with scholars to build science-based decision-making, and they insist on their interest for forms of knowledge that are not immediately used for resolving problems, but for opening new perspectives.

During the SWAN project, the idea of “Open Knowledge” has been strengthened by a collaborative process with local stakeholders. Giving their role as experts in different water management issues, their input has led to the project of implementing an Institute for Open Knowledge on Water (iOKW) at the University of Arizona. The iOKW has to be a both an academic center and a scientific network that is able to enhance the collaboration between European Union and United States, emphasizing relationships between researchers, industry, policy-makers, and general public. Moreover it has to value interdisciplinary communication between fields, countries, ideas, and novelty. Consistent with this mission, the establishment of a new academic offer should be positioned at the intersection of multiple disciplines, with specific attention to the ideas and practices of citizen science. The Feasibility Study has analyzed the current academic offer at the University of Arizona, where no center is working in such combined perspectives on the water issue.

Based on the research trends identified, the IOKW will define an institutional innovation that will develop three Strategic Research Areas (SRA) as flagships, and supported by 3 major Action Lines (AL) (see infra part 3). **More details are provided in the Deliverable 6.6.** The Strategic Areas of Research determined during the SWAN Project are:

- SRA1: Water Policy as Open Science and Collaborative Research
- SRA2: Urban Water Security
- SRA3: Socio-ecological systems and their services

The project encompasses 3 major Action Lines (AL) in order to achieve the goals of this scientific areas of research, namely:

- AL1: Management of Collaborative Research Projects, by a RDI Management Unit responsible for the planning, execution, monitoring and assessment of the projects. The latter will operate as business units and ultimately leverage products and services to the market, in the short, medium and/or long term.
- AL2: Promotion of Open Access to Environmental Data and Monitoring, in order to generate a common database to data available online (from official databases to databases that collect citizen science based studies) with access through an online portal. Indeed, the solution to environmental problems often requires data exchange at local, national and/or international level.
- AL3: Education and training to transdisciplinarity. Together with the University of Arizona, a program will be implemented to train graduate students to recognize the multiple facets of complex problems, work within a transdisciplinary research group and constructively deal with the challenges presented by such projects.

The Institute for Open Knowledge on Water's organizational structure consists of a board, a general management office and three units; namely, the Collaborative Research Unit (responsible for AL1), the Unit for Development of Citizen Science and Open Access to Big Data (AL2) and the Education & Training Unit (AL3). Partner institutions will have a representation in the board (voice and vote) and participate at all levels, while collaborators will have a project-based involvement. An advisory committee, composed of scientists and water professionals from each partner country, will be implemented in order to evaluate the action of the institute.

The model followed by the project of iOKW greatly benefits from the SWAM program structure that permitted lengthy periods of daily interactions among the researchers. European and English students and researchers lived in Tucson, Arizona for 3 to 6 months periods and had the opportunity to meet, discuss and work together on the SWAN project. In addition, week-long biannual meetings of the entire SWAN team provided additional forums for collaboration and development of the project undertaken. One of the important lessons established the SWAN students team working on water management in the Tucson area is the need for the use of case studies in the training of transdisciplinarity. Another important element is the need for a physical facility in which researchers could periodically meet. Although technology can assist on-going collaboration and communication, virtual meetings do not engender the same communication that results from actual meetings.

This Feasibility concludes the SWAN project with an ambitious objective: the implementation of a new institute, focused on new challenges addressed to the water sector, in the University of Arizona. Its realization remains submitted to several conditions: i/obtaining funds via grant proposals, as described above; ii/negotiating with the local academic institution in order to validate the training for transdisciplinarity. Several supplementary steps will thus be necessary in order to realize this objective: bi-lateral agreements between institutions in Europe and United States, implementation of an experimental phase in order to obtain the academic certification of the activities of the iOKW.

4.1.3.6. Management Strategy (WP6)

The objective of the management structure of the SWAN project was to facilitate the researchers' participation and enhance on-going or new research activities, in order to foster the European research capacity by implementing new collaborations between the UMI 3157 and the Partners in the field of water sustainability. This structure was designed to support the objectives of the project, coordinate the activities, ensure project compliance with EC rules, implement transparent decision-making, and facilitate efficient flow of information among the Partners and with the EU. Work Package 6 (led by CNRS) was designed to ensure an efficient management structure as well as the capacity to react to any problems, especially by organizing a regular communication and meetings (physical or electronic) between all the nodes of the network. WP 6 was also in charge of organizing the activities in order to produce the three main reports that lead to an institutional innovation between EU and the US. It included 18 Milestones that have all been achieved.

The management strategy organized by CNRS, has created a high degree of integration among the partners, crucial for achieving the SWAN project objectives. Two tasks were created to achieve these goals: 6-1: Project management; 6-2: Financial and administrative management. 6 deliverables were planned for WP6:

- D6.1 is the Consortium Agreement signed
- D6.2 Report on management and collaboration rules
- D6.3 First Consortium Report: "An agenda for a Sustainable Water Center"
- D6.4 Mid-term Consortium Report: Building integrated water research for sustainability

- D6.5 Report on the socio-economic action plan
- D6.6 Final Strategic Report: "Towards a Sustainable Water Center". This final report has been reformulated as an "Action Plan for an Institute on Open Knowledge on Water", in order to reflect the transformation of the project perspectives.

Task 6-1: Project management. The CNRS team has organized the work plan according to the management structure (Governing Board and Work Packages): relations between the tasks, completion of the deliverables in time, organization of agendas of the meetings and other informal exchanges (videoconferences, mail, phone and collaborative platform). All the SWAN teams have also contributed actively to the Regular online research meetings and to the Central Seminar Series. They have participated to the discussions related to the Final Report and the proposal for an Institute for Open Knowledge on Water. The following activities have been key in the advancement of the management of the project:

- 1- Regular contacts (Board meetings, Online meetings, etc.) have been maintained between the Coordinator and the Team Leaders, as well with the rest of the team members through meetings and regular emails. This communication has been useful to coordinate the different tasks of the project as well as its progress.
- 2- Regular Progress Meetings and Central Seminar have been realized in order to provide a platform for integration of efforts. An on-going series of regular weekly 2+ hour meetings were organized from 2013 on 2015 to work on the Tucson case Study. The meetings were broadcasted throughout the platform GotoMeeting, which allowed the members of the overseas SWAN teams to participate. These meetings have proved essential to the integration of efforts by overseas researchers and students with those of the University of Arizona and UMI teams in Tucson. They also allowed to strengthen the relations with local stakeholders (see below).
- 3- The Deliverables obtained from the different Work packages have been uploaded to the European Commission website, and the Milestones programmed for the different Work Packages have been achieved.
- 4- Students from each team visited the University of Arizona during this third period, and they were received by the UMi iGLOBES (CNRS/UoA) in collaboration with the Department of Hydrology and Water Resources (see the different reports for more details on the 18 students and researchers who came to the UoA).
5. Stakeholders' participation has been achieved through 3 Workshops (Tucson, October 2013; Seville, June 2014; Sofia, April 2015). Local stakeholders from Tucson have been engaged in the realization of the book related to the case study (see Deliverable 4.2: Water Bankruptcy in the land of plenty).

Task 6.2: Financial and administrative management

Description: this task implies:

- Carry out the Consortium Agreement signature process
- Formalize the management and collaboration rules within the consortium
- Set up the collaborative platform
- Manage the project financial issues
- Receive the advance payments from the European Commission
- Distribute the European contribution to the partners

- Implement the Certificate of Financial Statements
- Receive and compile the progress reports before sending them to the European Commission
- Organize the meetings
- Promote the socio-economic action plan within the network.

Achievements:

- Financial issues: the CNRS has received the second and third period payment from the European Commission and have distributed them in February 2016.
- Organization of the meetings: the EPM has contributed to the organization of 2nd SWAN International Conference. She has also co-organized the weekly group meetings, held at the University of Arizona, and broadcasted to the European teams throughout the GotoMeeting Platform. She has achieved the Deliverables of WP 5-6-7 and uploaded them to the EU Website and the SWAN Website.

4.1.3.7. Dissemination/communication (WP7)

WP7 (Dissemination and Communication Strategy) was led by the CNRS team based at the CNRS Joint International Research Unit UMI 3157/iGLOBES located at The University of Arizona. The 6 partners of the project took different roles to achieve the goals of the WP7, in order to disseminate information on the activities and results of the SWAN project to all relevant parties (European scientific community, stakeholders and policy makers, public). The activities of the WP7 focused in three major areas: the project website, the preparation of dissemination material and the organization of two international conferences.

Project Website: the website can be found via this web link <https://swanproject.arizona.edu/>. It was build using the content management system Drupal 7 and it was fully functional in June of 2013. This website meets the demands of a Collaborative Platform, and it provides the public with information and news about the SWAN project, including partner organization profiles; program of meetings; presentations from scientific water experts from various disciplines; and forthcoming events. Users can log in and access to their profile and modify it according to their needs. Moreover, the private site includes a drop box where the teams can exchange internal documents. Contents of the website have been updated periodically and the structure has been modified according to the needs of the project. Thus, a new tab ‘Reports’ was created during the second period in order to make available the non-confidential Deliverables to the public. Also, the ‘Activities’ tab was expanded in 2014 with two additional categories: Central Seminar and SWAN International Conferences.

International Conferences: two international conferences have been organized during the course of the project. [The first SWAN International Conference](#), entitled “*Data, Information and Knowledge for Water Governance in the Networked Society*” took place in Seville (Spain), in June 9-11, 2014. This Conference was organized by the USE SWAN team, in collaboration with the CNRS team and other members of the SWAN consortium. The goal of the Conference was to analyze the current debates and innovations on the issues surrounding the collaborative generation, processing and dissemination of data, information and knowledge for the management of natural resources in general and water resources in particular. The Conference was organized around four thematic

sessions: 1) Power, communication and the policy process; 2) Key debates on water management models; 3) Polycentric information for water governance: generation, quality control and sustainability; and 4) Key issues in information dissemination, visualization, and translation to different audiences.

The background of the International Conference dates back to a “Workshop on New paradigms in water resources and risks management: Key water data and information for sustainability”, organized by the USE SWAN Team on January 25, 2013. The relevance and interest of the topics discussed in this Workshop encouraged SWAN members to open up the debate to a wider international audience and undertake a more ambitious activity.

[The second SWAN International Conference](#), entitled “*Open Knowledge: Bridging Perspectives to Address Water Challenges*” took place in Tucson (AZ, USA) during February 16-17, 2016. A Pre-Conference Student Workshop entitled “Can we Talk? Designing a Transdisciplinary Education Experience” was held at the Biosphere 2 facilities on Monday, February 15, 2016. The main conclusions of this Workshop were presented during the Session 3 of the Conference “How to build a more comprehensive educational experience under a transdisciplinary context. The organization of both the Conference and the Student Workshop was led by the UA SWAN team in collaboration with the CNRS team. The scientific contents were discussed in a Committee integrated by SWAN members, and students and professors from the University of Arizona.

The major goals of the Conference were to: 1) Promote open availability and use of knowledge and data in the service of addressing water challenges; 2) Find better ways to take advantage of newly emerging tools for sharing and exploiting our growing storehouse of knowledge regarding Water and the Environment; 3) Promote stronger links between Natural Scientists, Social Scientists and various Stakeholders Groups (including the General Public); and 4) Develop multi-authored white papers on workshop themes. To achieve these goals, the Conference was organized using a workshop format, and was designed to highlight the strengths and challenges involved in adopting a trans-disciplinary perspective to water related issues. An important aspect of the meeting was a focus on the development and implementation of a trans-disciplinary perspective within the Educational Curriculum. The Conference was organized around 5 main topics/sessions: 1) Open Knowledge and Transdisciplinarity in the Era of Big Data: What Lessons for Water Governance? 2) Water Management in Tucson. Collaborative Research to Understand the Challenges of the Future; 3) Water, Energy and Food; 4) Ecosystem Services as a Bridge between Disciplines; 5) Adaptation to Climate and Other Changes. In addition to these sessions there were two keynotes, and a poster session

Preparation of dissemination material. During the course of the project different material has been prepared according to the emerging needs. Below there are listed the main dissemination material:

- [SWAN brochure](#): to publicize the SWAN project a brochure was designed in 2014, which describes the main goals of the project and provides the contact information.
- Special Issue on [Information and Knowledge for Water Governance in the Networked Society](#) in the international journal [Water Alternatives](#). Complementing the organization of the International Conference, the University of Seville SWAN team launched this special issue. Three members of the University of Seville team (Belén Pedregal, Leandro del Moral and Nuria Hernández-Mora) were the Guest Editors.

- The University of Seville team has published 3 issues of the [USE SWAN eNewsletter](#), a periodic online publication that presents the progress made by the USE team in the context of the SWAN project. The [first issue](#) was published in April of 2013 and contains a summary of the Workshop on New Paradigms in Water Resources and Risk Management. The [second issue](#) was published in October 2013 and it contains a summary of the research stays at the University of Arizona during 2013 and other activities of USE SWAN team members. The [third issue](#) was published in September 2014 and contains information on the International Conference and IV Progress meeting. The newsletters are available in the [SWAN project website](#).
- A book on water issues in the Tucson area entitled “Water bankruptcy in the land of plenty: steps towards a transatlantic and transdisciplinary assessment of water scarcity in Southern Arizona” has been submitted for publication. This book currently in press and is planned to be released by April of 2016. It will disseminate the most interesting scientific results of the SWAN project, will also constitute a model of research in practice created by the implementation of a network for a scientific dialog. The book has been edited by Franck Poupeau (UMI iGLOBES, CNRS/University of Arizona), Hoshin V Gupta (Department of Hydrology and Atmospheric Sciences, University of Arizona), Aleix Serrat-Capdevila (Department of Hydrology and Atmospheric Sciences, University of Arizona), Maria A Sans-Fuentes (Biosphere 2, University of Arizona), Susan Harris (Department of Hydrology and Atmospheric Sciences, University of Arizona), and Laszlo G. Hayde (UNESCO-IHE, Institute for Water Education). It will be published by CRC Press and disseminated with online free access by UNESCO-IHE
- [Web-based data viewer](#): the spatial data results from the book “*Water Bankruptcy in the Land of Plenty: Steps towards a Transatlantic and Transdisciplinary Assessment of Water Scarcity in Southern Arizona*”, are presented in a web-based data viewer. The viewer is designed to disseminate the spatial data results obtained from the authors of the chapters of the book through their research. The tool is a result from the collaborative work between the Spanish and the Bulgarian teams. The web-page is hosted at the server of Seville University, Spain. The web-address is: <http://www.gis-swan.org/>.
- The [Global Climate Monitor](#) has been developed by USE SWAN Team. It is a tool accessible at www.globalclimatemonitor.org that is supported in the design of a data model and a tool to geo-visualize global climate data and climate-environmental indicators. The latter are derived calculations or statistics that are easy to understand and capable of explaining weather patterns on a global scale to any potential user, within or outside the scientific community.
- [Website of the Second SWAN International Conference](#): Moreover, in order to publicize the 2nd SWAN Conference and to offer a portal for conference registration, a website was build using the Content Management System Drupal 7. The website is available at <http://swanopenknowledge.org/>
- A twitter account @waterP2P was also launched in order to disseminate the results of the first SWAN International Conference and serve as a node for discussions about these topics on twitter. This initiative was carried out by USE team.

4.1.4. The potential impact and the main dissemination activities and exploitation of results

A) POTENTIAL IMPACT

The potential impact of SWAN project can be analyzed in terms of **scientific research and institutional innovation**. It promotes a **new model of scientific work**, involving a diversity of national partners and disciplinary perspectives, into a **collaborative research** process. This process consists in implementing effective research practices oriented towards **transdisciplinarity**, thanks to the realization of scientific collaboration on specific case studies, involving natural and social sciences, academic and the public, and the institutionalization of training towards transdisciplinarity, in a proposal of Institute for Open Knowledge on Water.

The impact of such an Institute will be to strengthen a continuing collaboration in research between Europe and USA, and to help re-address how research in water issues is designed, by introducing in the projects the collaboration of stakeholders. The feasibility study will be presented at the University of Arizona. The impacts are thus related both short term and long term perspectives, and they concern 3 levels of action.

- 1) Institutional impacts
- 2) Educational impact
- 3) Political impacts

1) Institutional impacts on international scientific collaboration: how to strengthen a transatlantic dialog between US and EU

The institutional innovation resulting of the feasibility study is presented in the proposal for an Institute for Open Knowledge on Water. It will support:

- international collaboration implementing a transatlantic dialog on water
- interdisciplinary research perspectives between natural and social sciences
- collaborative research, oriented towards transdisciplinarity
- Research training on water issues.
- Dissemination of the results.

The iOKW will be both an academic center and a scientific network that is able to enhance the collaboration between European Union and United States, emphasizing relationships between researchers, industry, policy-makers, and general public. From an organizational standpoint, this will imply to develop several levels of institutional innovation:

- An international collaborative training program on understanding water related issues, and on improving mechanisms for water management,

- A mechanism for students and staff mobility between partners, particularly with arrangements for student exchange and study,
- A vehicle for organization, management and dissemination of cutting edge collaborative research,
- An organizational structure, based at the UMI iGLOBES at the University of Arizona, to provide the necessary support for the iOKW.

The iOKW will operate as an academic center, a scientific network, and a data center with the ability to: i) enhance the collaboration primarily between European Union and United States while open to additional countries, ii) and emphasize relationships between researchers, industry, policy-makers, and general public. Research, education and data management will thus be closely interrelated. Research will be the main driver of both the training program and data generation. An institute such as iOKW will complement other existing interdisciplinary/transdisciplinary centres at the University of Arizona that conduct research and education in fields other than water: CLIMAS (Climate Assessment for the Southwest, current center), LTRR (laboratory of Tree Ring Research, current center), and Colleague of Optical Sciences. These centers promote education and research in an interdisciplinary/transdisciplinary environment.

Consistent with this mission, the establishment of a new academic offer should be positioned at the intersection of multiple disciplines and oriented towards community and stakeholders. It would be particular strategic to establish an offer that draws attention to the ideas and practices of open knowledge, and more specifically citizen science.

2) Educational impacts on collaborative research activities: A new model to develop training activities for transdisciplinarity

A main target for the development of multi- and trans-disciplinary research within the countries is education. At the moment university education is usually focused on the training of students to become specialists in a particular discipline and how to apply their knowledge for solving problems in the same discipline. There is not enough training on the understanding of the “big picture” – realizing the background of the problems and the consequences that its solution (or lack of solution) might bring.

The attempt to establish an interdisciplinary, applied curriculum focused on training is valuable and it has to find its place in the frame of the academic space of the University of Arizona. Although the University of Arizona has long been a leader in interdisciplinary and multi-disciplinary research and education, interdisciplinary education, and furthermore transdisciplinarity on water is still underachieved. While the focus on water, training, and community is already moderately represented at the University of Arizona, the focus on all these three elements is virtually unrepresented. Filling this gap would guarantee a status of originality to the curriculum covered by iOKW.

Consistent with this mission, the establishment of a new academic offer should be (a) positioned at the intersection of multiple disciplines, (b) strongly focused on applied training, (c) oriented towards community and stakeholders, and (d) different from already existing opportunities. Given these four points, it would be particular strategic to establish an offer that draws attention to the ideas and practices of open knowledge, and more specifically citizen science. The attention and interest towards citizen science constitute a real opportunity for the impact of the iOKW. In order to benefit from the collaboration and employment of general public, such an institute must provide properly designed protocols, rigorous training materials, and close professional assistance. This emphasis on training matches the interest of iOKW with regard to the creation of an applied curriculum that is in

line with its interdisciplinary and community-oriented mission. Furthermore, it is worth noting that this training, which can result in a certification released by the iOKW, may be available not only to nonprofessional volunteers, but also to scholars and researchers (e.g., undergraduate and graduate students, junior researchers, researchers who are new to interdisciplinary work for which they are not fully equipped, and so forth) that need to develop specific applied skills that, for a variety of reasons, they lack.

The training activities will be directed to fully explore the many interrelated facets of water management. The first steps towards the implementation of transdisciplinary water research and education have been already taken by the SWAN project. SWAN benefitted from the examination of water issues from the different perspectives brought by researchers from six different countries (EU and USA), and multiple disciplines into a common case study. The experience has shown that given the complexity of the issues involved, a transdisciplinary approach must be applied to water issues to merge the expertise, knowledge and efforts of political and physical scientists, students, policymakers, together with industry, agricultural and environmental organizations to identify and implement workable solutions. The model to follow for transdisciplinarity training on water will be:

- i. Establishment of at least two case studies (one USA and one EU).
- ii. Students will spent from 3 to 6 months periods in the two different case studies. The students will belong to different disciplines related to water (hydrology, environmental sciences, social sciences, geography...)
- iii. At the beginning of the study, the students will identify the problem and the key organizations/stakeholders that might be relevant to this issue.
- iv. A transdisciplinary research plan will be proposed to explore this problem. The students will focus on current water problems affecting people and the environment without being distracted by administrative issues, or hampered by a lack of coordinated efforts, pointless internal conflicts or a failure to completely engage.
- v. Each group of students will have a facilitator that will enable the team to timely accomplish work, and constructively resolve conflicts.
- vi. Periodic meetings among students will be planned in order to give updates on the progress of the research and propose new strategies as needed. Also, periodic meetings to work together with stakeholders will be planned. These meetings will allow to explore if workable solutions can be implemented.
- vii. Meetings will be organized where students working in EU case study and USA case study will compare results. In order to coordinate this transdisciplinary education, the iOKW will have a director or facilitator with experience in transdisciplinary research. The director will contribute significantly to integrate the results obtained by different group of students working in the cases studies.

This research/education path will be accompanied by an appropriate academic offer that will allow students to acquire the basic knowledge necessary to work in the Cases Studies. This academic offer will be available both on-site class and online. This is based on the model followed by the SWAN team that greatly benefitted from the project structure that permitted lengthy periods of daily interactions among the researchers. European and English students and researchers lived in Tucson, Arizona for three to six months periods and had the opportunity to meet, discuss and work together on the SWAN project. In addition, week-long biannual meetings of the entire SWAN team provided additional forums for collaboration and development of the project undertaken. The SWAN team did

conduct weekly meetings among the researchers living in Europe and the United States using the latest in technology, but no technology can substitute for in-person meetings, workshops, and the daily collaboration where researchers work in close physical proximity to each other.

As for the scientific openness, the interest towards public participation to scientific activity is growing and timely, and his endeavor can take advantage of the technologies now available not only in the Web 2.0 (e.g., social media), but more specifically in the education industry (e.g., D2L, an eLearning platform already available at the University of Arizona).

3) Political impacts on decision-making: A new kind of collaborations in the water sector

The current and future context global water research allows for the economic sustainability of the Institute for Open Knowledge on Water. The following potential partners per sector, have been identified:

- i. **Water utilities:** The implementation of water conservation policy by local American institutions like Tucson Water and Salt River Project constitutes a real model of management that might be imported to Europe. Indeed, it includes technical solutions (wastewater and storm water management) and participative processes.
- ii. **Regional and local governmental institutions in the USA and Europe:** In most of the cases, regional and local governments lack of capacities regarding water and environmental management, while have important funding to take action. The list of stakeholders established in the different Deliverables (5.2, 5.4, 5.5) will be used to make these connections.
- iii. **Academic institutions:** In regards to the role of academia in the modern society and decision-making process, the views are different between countries. Very often the position that academia takes is tactical – looking for realization on the places where scientific skills are applicable. But there are contradictory demands to academia and very often scholars need to adapt in order to get funding. Scientists should provide objective information in search for the truth. However, in the USA there are a lot of funds for scientists to support decision-making and solve present problems: the function of the iOKW is very complementary to these applied research institutions, as it will provide fundamental research perspectives in collaboration with actors (such as communities, citizen associations, etc.) generally not taken into account by applied research.

By institutionalizing an international collaborative research, the iOKW proposed by the SWAN project will improve not only the dissemination of scientific results (cf. see infra: Scientific impacts section 4a), but it will create a space of dialog and exchange between scientists, water professionals and citizens, based on the implementation of collaborative research, and open science perspectives (cf. see infra: Scientific impacts section 4b). As the demands of the SWAN stakeholders were oriented towards the production of scientific knowledge, the iOKW aims at building a new kind of science-based decision making, that would not be bases on academic expertise but on the implementation of collaborative research processes.

B) Dissemination activities and exploitation of the results

a) *Dissemination of the scientific results.*

At the date of February 2016, twenty five peer reviewed publications have been achieved by researchers involved in the SWAN project (and more are to come in the next months), but two main publications realized by the SWAN Partners constitute the most visible final results of the activities achieved by the consortium:

- Special issue of *Water Alternative* (2015, vol.8, n°2: www.water-alternatives.org), coordinated by Cabello, V.; Hernández-Mora, N.; Limones, N. and Del Moral, L. & Pedregal, B.: “Information and knowledge for water governance in the networked society”.

The articles of this special issue of one of the most important specialized journals on water show that in the last few years, parallel evolutionary processes in the socio-political, governmental and technological arenas have been providing new pathways for the collaborative generation, coordination and distribution of polycentric information. From a technological perspective, the proliferation of information and communication technologies (ICTs) has boosted the availability of information about our planet, along with its storage, processing and dissemination capabilities. The Worldwide Web and satellite and electronic sensors combined with smart phone technologies have also opened new means for social, political and scientific innovation. From a socio-political standpoint, the implementation of policies that encourage the reutilization of data and protect the right to information of interested parties, together with growing social demands for transparency, have resulted in an increasing number of governments drawing strategies to open up public data. In this context, this paper addresses two main topics that will be key drivers for improved water governance in the near future. First, it discusses new practices of collaborative and distributed generation and disclosure of information for water governance, and the resulting challenges and opportunities afforded by the use of ICTs. Second, it looks at the interplay between the uptake of ICTs and institutional frameworks, social dynamics and technological structures within which they operate to understand the extent to which ICTs affect decision-making processes and contribute to creating alternative spaces for the production of common services or alternative discourses. Despite the advances in open data policies, findings suggest that there remain significant challenges to take full advantage of the opportunities offered by ICTs, mostly derived from the structural conditions of existing models of decision-making, and information generation and management. It seems that the potentialities of ICTs as transformative tools are conditioned by the regeneration of the context within which decisions are made, that is, the democratic process itself.

- The book: *Water Bankruptcy in the Land of Plenty. Steps towards a transatlantic and transdisciplinary assessment on the nature and causes of water scarcity in Southern Arizona* (coordinated by F. Poupeau, H. Gupta, A. Serrat-Capdevila, M. Sans-Fuentes, S. Harris, L. Hayde), will be published in 2016 by CRC Press, and will be available on line, facilitating the access to the scientific contents and the narrative of the SWAN project.

The book states that many newspapers and specialized books published in recent years have emphasized that the Southwestern US will be facing its most severe “drought” to date, reducing the complexity of this phenomenon to simply “a scarcity of natural resources, ignoring the fact that the character of a drought has many dimensions: including *meteorological* (prolonged below-average precipitation), *hydrologic* (the way in which meteorological drought manifests as reduced streamflow and depleted aquifers), *agricultural* (driven by and impacts to agriculture demand) and *socioeconomic* (driven by and impacts to other socio-economic sectors).” The resulting water scarcity is a product of the complex interplay between physical availability, the environment, and human demands and behaviors. In other words, in today’s world, the public narratives of “drought” and “water scarcity” are in large part a social construct associated with progressive economic growth and a widespread assumption of consumptive lifestyles. And,

regardless of whether water scarcity is actually due to natural climatic variability, global warming, hydrologic change, land cover change or the ever growing urban and agro-industrial pressures placed on a finite resource, the public focus is most often on the insufficiency of physical supply and the “scarcity” of natural resources, rather than on the analysis of human processes that mediate the governance of water.

This book proposes and explores the purposely provocative notion of “water bankruptcy” so as to emphasize the socio-economic dimension of water issues in the Southwestern US (an primarily Arizona), between the narratives of growth and the strategies or policies adopted to pursue competing agendas and circumvent the inevitable. Given this long-term trend, the current drought might indeed present a window of opportunity in which to induce change and to challenge the hegemonic discourse that governs the management of water resources in the American Southwest. Importantly we now have an opportunity to deal with the threats that derive from imbalances between growth patterns and available resources, the primary cause of scarcity.

A first of its kind, developed through close collaboration of a broad range of natural scientists, social scientists, and resource managers from Europe and United States, this book is a committed step towards the collective elaboration of a transdisciplinary approach to unveiling the inner workings of how water is fought for, allocated and used in the Southwestern US. It offers an innovative scientific perspective that dissects the conflicted nature of our relationship with water and the environment. It produces a critical diagnostic evaluation of water problems in the West, with a particular view to identifying risks for the Tucson, Arizona, area (which is facing continuous urban sprawl and economical growth). The book presents a diversity of complementary perspectives, including a statement of natural resources, biodiversity & their management in Arizona, an analysis of the stalemates in drought management and their roots in the history of water policy, and a statement of ecosystem services in the context of both local biodiversity and also the economic activities that sustain economic growth (such as mines and agriculture). Finally, this book is a concerted effort to explore the interplay between a variety of related scientific disciplines including climatology, hydrology, water management, ecosystem services, societal metabolism, water governance, political economy and social science.

The results of the book will not only be disseminated to the academic community. After the end of the SWAN project, SWAN partners will present it to the community of water professionals (City of Tucson, Pima County, ADWR, CAP, SRP, etc.) and citizen associations involved in water management in Tucson and Arizona.

b) Dissemination of Open science activities: Global Monitor and Visualization Tools

The University of Seville from the SWAN project has implemented the Global Climate Monitor which constitutes an exemplary model of open knowledge into action, and should be generalized in other dimensions of water management. (<http://www.globalclimatemonitor.org/>) that is supported in the design of a data model and a tool to geo-visualize global climate data and climate-environmental indicators.

These indicators are derived calculations or statistics that are easy to understand and capable of explaining weather patterns on a global scale to any potential user, within or outside the scientific community. It therefore falls in the area of Open Knowledge, as its primary objective is to make complex data easily available. A set of derivative indicators from that database are displayed, offered at monthly, seasonal and annual scale. All the applications used to create Global Climate Monitor are open source. The system is based on a multilevel architecture in three layers: a Data layer to classify the data used by the system; a Business layer presenting the data to the users via a map server and a web server; a geo-viewer that is the visible component of the system. This level is the viewer itself,

which is accessible on the website of the Global Climate Monitor. Users can easily find basic tools to zoom and to move over the map, as well as two information buttons: the top button is used to obtain information on the value of the variable at the point clicked and the other shows an overview of the variable currently displayed on the screen.

The University of Seville and the Bulgaria Academy of Sciences have also implemented a second tool for socio-environmental data open access on: www.gis-swan.org. GIS SWAN is a web viewer containing accessible water resources information. It aims at disseminating some of the research results obtained during the project for the Tucson Basin area (TAMA). From this point of view geo-layers representing the water system, the land cover system and the territory system of Tucson Basin as well as geo-layers produced by the SWAN project research teams have been integrated in SWAN GIS geo-viewer. In practice, we consider this tool as a good example of open knowledge dissemination and a way to connect science and citizens.

c) Conference organization (see section 4.1.3.7 for more details): during the course of the SWAN project two international conferences have been organized. The first one, entitled “Data, Information and Knowledge for Water Governance in the Networked Society” took place in Seville (Spain), in June 9-11, 2014. This Conference was organized by the USE SWAN team, in collaboration with the CNRS team and other members of the SWAN consortium. The second International Conference, entitled “Open Knowledge: Bridging Perspectives to Address Water Challenges” took place in Tucson (AZ, USA) during February 16-17, 2016. This Conference included a Pre-Conference Student Workshop entitled “Can we Talk? Designing a Transdisciplinary Education Experience” was held at the Biosphere 2 facilities on Monday, February 15, 2016.

Both conferences aimed at disseminating the results of the project and tightening the links between research groups and stakeholders, opening the door for new collaborations.

d) *Website*: the website (<https://swanproject.arizona.edu/>) presents the different events organized by the SWAN consortium (International conferences, progress meetings, stakeholders workshops, specific national initiatives, etc.). It also disseminates the 8 scientific reports corresponding to the 4 Work Packages of the project.

e) *Participation to conferences, seminars and workshops*. The SWAN partners have already participated to many scientific events where they have presented the activities of the network and its major outcomes. An important characteristic of the academic dissemination SWAN consortium is that the participation to these events were both on natural sciences and social sciences conferences (American Association of Political Science, Eastern Society of Sociology, American Geophysical Union, European Geosciences Union, Ecosystem Services Partnerships).

f) The SWAN consortium, led by H. Gupta (Department of Hydrology, University of Arizona) and Aleix Serrat-Capdevila (UMI iGLOBES CNRS/University of Arizona) has also organized, from 2013 to 2015, a Central Seminar that played a key role in the making of the stakeholders engagement and the making of the Tucson case study. Not only scholars but regional water professionals contributed to the sessions (see program in the reports of Period 1 to 3).

4.1.5. Website of the project and contact details

Project website: <https://swanproject.arizona.edu/>.

Contact details:

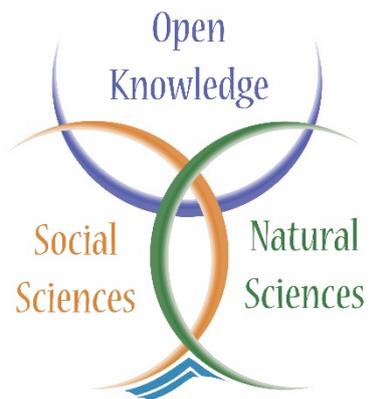
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Project logo



Second SWAN International Conference logo



SWAN Brochure: available at <http://swanproject.arizona.edu/sites/default/files/SWAN-Brochure.pdf>

4.2 Use and dissemination of foreground

Section A (public)