

出國報告（出國類別：國際會議）

## 出席水教育高峰論壇報告

服務機關：科技部科教發展及國際合作司

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派赴國家：美國

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## 摘要

水教育高峰論壇是引領教育工作者提升生態保護管理的研討會，特別是針對永續議題中水資源管理，透過與會者的研究與討論，傳達正確及新穎的水資源觀念。今(103)年度大會討論的主題包括氣候變遷、生態系統的復原與保護、以及政府官員和決策者的教育專案等議題，是各國環境教育工作者相互交流的平台。參加本次會議吸收到永續目標下的水資源挑戰及領先的科普及科學教育工作議題，有助於本司科學教育及公民科技素養學門業務日後之判斷與討論。

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## 壹、前言

全球的水資源只有少於 2.5% 是淡水，其餘都是海水，而其中僅有少於 1% 的水資源可供人類直接使用，這些水資源分佈也不平均，因此世界上很多地方都缺乏清潔安全的食用水供應。人口成長、氣候變遷和經濟發展正影響著全球的水質和數量，本世紀我們將面臨越來越多有限的且非常寶貴的水資源壓力。從河流污染、濕地減少及水資源管理不善，我們的地球淡水資源正承受著越來越大的威脅。面對這些挑戰，在地球上的我們，每一個人都有責任，確保我們可持續地運用地球上的水資源，無論是機構、地主、農民、社區領袖或專業人士，都可以在當地立即採取行動，嘗試改變調整現況。台灣每人每年可獲得的水量僅為全球平均的八分之一，是世界排名第十八的缺水國家，身為台灣科學教育工作者之一員，也應負起推廣有效水資源管理的任務。

2014 年水教育高峰論壇（2014 Water Education Summit）在北卡羅萊納州阿什維爾（Asheville）舉辦，本次重點為水資源的挑戰、在地化的改變之道，是一個與傑出的教育工作者交流的機會，有利於提高水資源的保護和管理的知識與能力。討論的方向包括氣候變遷、生態系統的復原和保護、流域規劃、政府官員和決策者的教育專案等議題，透過演講、討論、研討會和技術參觀將強調運用資訊、技術移轉及動手學習等創新的經驗與方法，來改變人們的行為，並激勵在地化水資源管理。

## 貳、目的

參加 2014 年水教育高峰論壇，吸收永續目標下的水資源挑戰及領先的科普及科學教育工作議題，有助於本司科學教育及公民科技素養學門業務日後之判斷與討論，傳達正確及新穎之教育觀念。

## 參、議程

議程詳如附件一，與會人員詳如附件二。

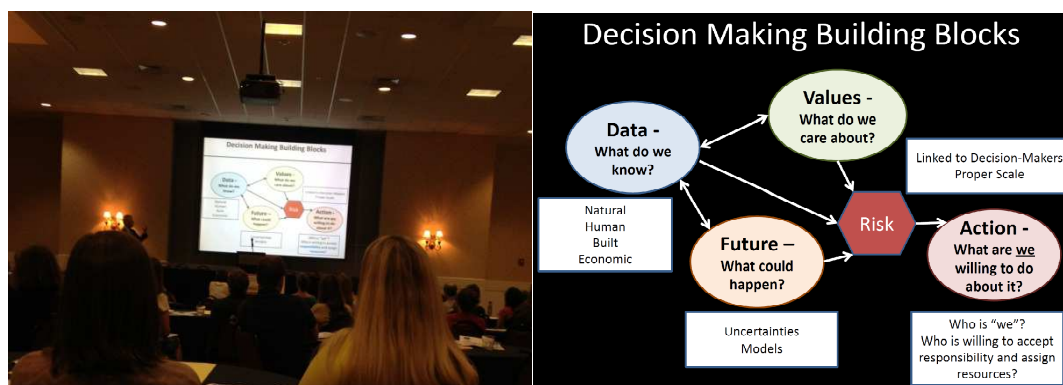
## 肆、過程

經過漫長的飛行與轉機，終於到了會議舉辦地點阿什維爾，該地位於美國北卡羅萊納州西部，是大煙山山腳下一個充滿藝術氣息的小鎮。北卡羅萊納大學生物與農業工程教授 Karen Hall 博士為大會致開幕詞，致詞當中提到參與本次會議的專家學者來自全球各地，還特別列出台灣，讓與會的專家們也對於這遠道而來的我特別好奇，我也很高興傳達台灣對水資源科學教育的重視。



Karen Hall 博士致開幕詞

北卡羅萊納大學阿什維爾分校之國家環境模擬與分析中心 James Fox 主任，主題演講為「Water Resources in the Southeastern US - Quantity, Quality, and Demand: How does a changing climate reality impact our daily lives」，他以美國東南部之水資源為例，告訴大家為什麼應該關心氣候變遷對地區的水資源影響等驅動力（如人口成長），面對氣候變遷的現況，乾旱增加以及強烈驟雨都直接影響水的數量，甚至導致洪水氾濫。身在地球的每一個區域，面對這些影響，必須採取行動，由區域性的數據評估“什麼是我們可以做的？”、“什麼是我們需要開始承擔責任和分配資源的主要區域目標？”，進而形成決策，以區域性的行動計畫來進行改變，關注水資源問題並加強抗災能力。



James Fox 主任提出之行動框架形成要件

會議現場有一些展示海報，例如 Storm Water Systems 展示捕集河川枯枝落葉的設計方案、North Carolina Forest Service 展示保護和推廣森林資源的最佳管理方法、North Carolina Forest Service 的飲用水資源海報等，這些都是作為教育、推廣及訓練使用的作品。



展示攤位

卡羅萊納綜合科學與評估氣候專家 Amanda Brennan 在分組討論發表「From Global Climate Models to Local Choices: Lessons Learned about Providing and Using Climate Information in the Carolinas」，提到利用現有網絡工具 Community Collaborative Rain, Hail & Snow (CoCoRaHS) 提供完整雨、冰雹和雪的數據以及自然資源、教育和研究應用論述，來提高民眾對於當地的降雨、缺水、或暴雨事件影響動植物的認知，也提供地面氣象的蒐集和氣候的影響等資訊，強化科普實用性，讓民眾更切身了解氣候對生活

的影響和衝擊，以減少一般大眾對科學的認知或對此議題的關切差距。



氣候專家 Amanda Brennan 演講

福賽斯郡建教合作推廣與教育專家 Wendi Hartup 在分組討論場次發表「Snaking Your Way Through the Political Masses」，介紹後院河流修復解決方案。由於河川上的水或風在流動的時候，會帶走地表的土壤，使土地變得貧瘠，甚至引起植被破壞與地表裸露，再加上氣候變遷，侵蝕作用也會造成河流泥沙淤積，導致水流不順暢及混濁，更嚴重還會導致洪水氾濫或河流改道，而當河岸得不到保護，泥沙淤積物有可能會侵襲進入人類居住的環境裡，進而威脅到房屋的穩定性。他提出使用原生植被和自然通道的設計概念與方法，以防止侵蝕。



推廣與教育專家 Wendi Hartup 演講

佛羅里達大學波爾克縣自然資源推廣與教育專家 Shannon Carnevale 在另一場的分組討論中發表「Recruiting Political Audiences for Extension Programming」，提出在州內校園推展的水利學校水資源及保護推廣計畫。水利學校推廣計畫的總體目標是透過演講或活動提供知識並實地考察落實，賦予社區領導者執行政策與實踐水質和節約用水

的計畫目標。涵蓋的主題包括水文系統的概述、水質和實用性的挑戰、政策和法規、成功案例以及民眾參與。水利學校推廣計畫所面臨的挑戰包括必須具備有吸引力的招募策略及發展有效的評估工具，促使此計畫能擴及在整個州執行。



自然資源推廣與教育專家 Shannon Carnevale 演講

## 伍、心得與建議

### 一、心得

暖化現象反映在天氣的呈現上，已經導致劇烈天氣出現的頻率增加，更是人類未來的危機。阿什維爾當地因氣候變遷使得其更加容易有驟雨發生，情況與台灣相似，能出席本次環境教育的重要會議，和其他與會的政府人員及學者分享資訊，也顯示台灣對水資源永續保護及大眾科學教育工作的重視。本次會議見習到政策面的管理，從面臨問題到數據資訊的蒐集到可能的風險評估然後策略形成最終是行動落實，這是決策面很重要的思考鏈與管理模式。另一方面，專家學者們也提出很多對環境永續的保護措施與復原方法，在很多地區先利用區域性即可很快實施。此外，努力將生態環境教育推廣至各級學校，讓科學教育從小做起，透過實務性操作，使教育更加豐富有趣，以利達到高效率的訓練目的。

### 二、建議

1. 科學教育在地化與全球化是世界趨勢，多利用網絡平台提供大眾有關科學環境更多的資料蒐集與資料分析的資訊，能夠引導大眾面對水資於問題並參與解決水資源問題的各项措施，提高行政措施的執行率。另外很多措施也可以在地化的區域內先行實施，再逐步擴大實施範圍。



2. 阿什維爾當地的節能教育有很多是在校園內實踐,由學生自己動手照護農田、學習設置貯留雨水或溪水系統以作為農田灌溉所需等等方法。科學教育由實務性的操作做起,並且就在身邊的環境裡,對於教育特別是環境教育的推廣及生活應用上,會更有學習興趣也會更有學習效果。

## 陸、攜回資料

1. Water Education Summit 2014 Agenda
2. Riparian & Wetland tree planting pocket guide for North Carolina
3. Be Firewise™ Around Your Home
4. Forests and Water: Helping to Meet the South's Water Needs Today and Tomorrow
5. Keeping Sediment in Check with BMPs, Snapshot: 2011 Report on Logging Activities in North Carolina
6. Forestry Leaflet: Protecting Water Quality at Stream Crossings
7. Western North Carolina Vitality Index

## 附件一 水教育高峰論壇議程

Monday, 9/8/2014 ~ 1:00pm - 5:00pm General Session (Registration opens at 11:00am)				
Expo Center				
1:00-1:15	Welcome and Conference Overview - Karen Hall, NC State University			
1:15-1:20	Introduction to Session: Engaged Scholarship and Applied Learning on College Campuses: Tackling Water Issues Within a Sustainability Framework - Michael Kensler, Auburn University			
1:20-5:00	Keynote: Water Resources in the Southeastern US - Quantity, Quality, and Demand: How does a changing climate reality impact our daily lives - Jim Fox, UNC Asheville			
	Healthy Cities-Healthy People: A Comprehensive Strategy for Making Washington DC the "greenest, healthiest, most livable city in the nation - Dwane Jones, University of District of Columbia			
2:15-2:25	Break	Break	Break	Break
	Comprehensive Campus-wide Water Management at Georgia Tech - Howard Wertheimer, Georgia Tech			
	Engaging Students (& ruminants) to Improve Campus Watersheds at UGA - Kevin Kirsche, University of Georgia			
4:00-4:10	Break	Break	Break	Break
5:00	General Session Adjourns			
5:30-6:30	Poster Presentations & Social (light hors d'ouvres)			
6:30	Evening Gathering at Ben's Tune-up (Dinner on your own); 195 Hilliard Avenue, Asheville			
Tuesday, 9/9/2014 ~ 7:45am - Continental Breakfast; 8:15am - 12:00pm Concurrent Sessions				
TIME	Global Water Quality in a Changing Climate (Mt. Mitchell) Moderator: Dan Hitchcock	NC Water Stewardship Network- Special Session (Mt. Roan) Moderator: Christy Perrin	Social Media Extravaganza! (Special Session) (Foxfire) Moderator: Mitch Woodward	Irrigation (Special Session) (Dogwood) Moderator: Dara Park
8:15-8:35	The Effects of Global Climate Change on Water Quality: Stormwater Management to Address Future Impacts-Fred Grogan	"Successfully Recruiting Public and Private Partners in Watershed Improvement Projects: A Roundtable Symposium"-Christy Perrin	Give Stormwater a Voice: Writing Public Service Announcements for Radio-Teresa Lott	Why Irrigation Quality Matters: Understanding How Water Influences Plant Growth and Soil Structure - Dara Park and Sarah White
8:35-8:55	From Global Climate Models to Local Choices: Lessons Learned about Providing and Using Climate Information in the Carolinas-Amanda Brennan	Facilitators for this session include: Paul Clark, DWR-NCDENR; Michele Drostin, UNC-IE; Gloria Putnam, NC Sea Grant	Educational Videos Characterizing South Carolina Water Resources-Chandler Green	
8:55-9:15	An Analysis of Water Quality in Haiti and the Importance of Post-2015 Millennial Development Goal Follow-Through-Jessica Brown	Rebecca Sadoksy, DWR-NCDENR; Nicole Wilkinson, WRRI, plus "experienced veterans" from local watershed groups.	YouTube and Urban Stormwater-Mitch Woodward	
9:15-9:35	Inadequate Waste Disposal Polluting Dominican Republic Watersheds- The correlation between toilet availability and Escherichia coli presence in public-access water in the Dominican Republic-Dominique Smith	<i>This session ends at 9:45am.</i>	Social Media Skeptic or Facebook Fanatic? Finding an effective virtual voice for water outreach-Michael Griffin	

Tuesday, 9/9/2014, Concurrent Sessions Continued				
TIME	Global Water Quality in a Changing Climate ( <i>Mt. Mitchell</i> ) Moderator: Dan Hitchcock	NC Water Stewardship Network-Special Session ( <i>Mt. Roan</i> ) Moderator: Christy Perrin	Social Media Extravaganza! (Special Session) ( <i>Foxfire</i> ) Moderator: Mitch Woodward	Irrigation (Special Session) ( <i>Dogwood</i> ) Moderator: Dara Park
9:35-9:55	Water Supply, Water Quality and Quality of Life in Western North Carolina-Jay Johnston		Understanding Watershed Connectivity with 2 NSF funded interactive web interactives called "Navigate a Watershed" and "Model My Watershed-Lucy Laffitte, Susan Gill	
9:55-10:15	Onsite Wastewater Treatment Systems Effect on Stream Base Flow and Nitrate Concentrations in Metropolitan Atlanta-David Radcliffe		Creeklife.com: A New Crowdfunding Platform for Protecting North Carolina's Watersheds and Cleaning up the Environment-Mark Contorno	
10:15-10:30	Break	Break	Break	Break
	Engaging Public Officials and Decision-Makers ( <i>Mt. Mitchell</i> ) Moderator: Bill Lord	Educational Programs and Projects ( <i>Mt. Roan</i> ) Moderator: Cathy Reas Foster	Green Growth, Design and Infrastructure ( <i>Foxfire</i> ) Moderator: Cal Sawyer	Agriculture and Forestry Systems ( <i>Dogwood</i> ) Moderator: Dara Park
10:30-10:50	Know Your Groundwater: A State Effort to Aggregate and Assess Water Quality Data for the Benefit of Local Government Decision Makers-Amy Keyworth	The Georgia Adopt-A-Stream Program Flows into South Carolina- Cathy Reas Foster	Smart Growth and Sustainable Design: Connecting the Dots-Frank Hahne	Development of an Irrigation Water Quality Flow Chart fo Assessing pH, Salts, and Alkalinity-Dara Park
10:50-11:10	Snaking Your Way Through the Political Masses-Wendi Hartup	Rocky River Wetland Usage for Education and Recreation-Early Planning and Implementation in anderson County, South Carolina-Thomas Kozel	Where the Streams Meet the Pipe - Innovative Infrastructure Protection in Riparian Corridors-Eve Brantley	Forestry BMP Education and Training in the South-Tom Gerow
11:10-11:30	Recruiting Political Audiences for Extension Programming-Shannon Carnevale	Developing the Watershed Stewards Academy Program to Education Florida Residents about Local, Regional and State Water Resources-Lara Miller	Developing a Site-Specific Education for Green Infrastructure-Calvin Sawyer	The Effect of Winter Forage Planting Methods on Water Quality in a Beef Cattle Grazing System-Donna Morgan, Dr. Glen T. Gentry, Jeff Gurie.
11:30-11:50	Knowledge, Attitudes, Barriers and Benefits to Rain Garden Adoption in Columbia, MD-Amanda Rockler	Designing Human Connections into Stormwater Management: The Mars Hill Stormwater LID Demonstration Project-Tim Ormond	Advancing Green Infrastructure in the District of Columbia-Dwane Jones	Catalyzing Collaborative Cover Crop Conversations: Peer-to-Peer Learning to Reduce the Gap between Research and Practice-Mace Bauer
11:50-12:45	Lunch	Lunch	Lunch	Lunch
12:40pm	Board shuttles for tour.			
12:45-6:00	Urban Stormwater & Industrial Water Management TOUR. After the tour, shuttles will make stops in downtown Asheville and the Crowne Plaza Hotel.			
1:00-5:00	WORKSHOP: Integrating Urban Agriculture and Urban Stormwater ( <i>Mt. Mitchell</i> )			
	End of Day 2			

Wednesday, 9/10/2014 – 7:45am - Continental Breakfast; 8:00am - 10:35am Concurrent Sessions					
TIME	Community Partnerships (Mt. Mitchell) Moderator: Gloria Putnam	Youth Education (Mt. Roan) Moderator: Amanda Gumbert	Watershed Modeling and Planning (Foxfire) Moderator: Forbes Walker	BMP Demonstration Projects and Case Studies (Dogwood) Moderator: Jonathan Page	Smart Growth (Special Session) (Magnolia) Moderator: Frank Hahne
8:00-8:20	Water Resources for Realtors: Matching Professional Motivations with Aquatic Science Education-Rebecca Tharp	How Many Water Drops Fit on a Penny?-Lena Beth Reynolds	Jordan lake, NC, and Other Impaired Reservoirs Need and Adaptive Systems Approach to Freshwater Management-Ken Hudnell	Community Wetlands: A Case Study for Mucking It Up-Wendy Patoprsty	Smart Growth and Sustainable Design-John Thomas and Frank Hahne
8:20-8:40	Engaging Homeowner Associations to Reduce Nutrient Runoff in Stormwater Ponds-Michelle Atkinson	Snapped: Using Photojournalism to Connect to Your Watershed-Amanda Gumbert	Modeling Watershed-Scale Impacts of Bioretention on the UGA Campus-Laura Keys	Seeing is Believing: Creating Demonstration Sites to Interpret Water Resource and Environmental Horticulture Best Practices for Residential and Commercial Audiences-Kimberly Counts	
8:40-9:00	Promoting Stream Stewardship at the Discovery Trails in Dillsboro, NC-Roger Clapp	Bringing Water Education to the Classroom Successfully: Techniques and Tools to Get in and Stay in the Schools-Michele Drostin, Joy Fields	Application of Mathematical Model for Prediction of River Migration: An Application for Sustainable Landuse and Planning-Samuel Beadles	Rain Gardens for Tennessee Smart Yards-Andrea Ludwig	
9:00-9:20	Connecting Communities Through Their Connection to Water-Susan Licher, Victoria Kramer, Chenille Williams	Where Do We Go From Here? Ways to Expand a Long-standing Education Program to Optimize Outreach, Stewardship and Impact Value-Erin De Vries	Teaching an Old Model New Tricks: SWMM and Watershed-Scale LID Planning-Lee Gentry	A Sustainable Infrastructure Case Study-Low Impact Development at the New Belgium Brewery-Dena Chandler	
9:20-9:35	Break	Break	Break	Break	Break
	Community Conservation (Mt. Mitchell) Moderator: Andrea Ludwig	Computer Programs (Mt. Roan) Moderator: Mark White	Ecological Restoration (Foxfire) Moderator: Barbara Doll	Stormwater Management (Dogwood) Moderator: Guinn Garrett	Citizen Monitoring (Special Session) (Magnolia) Moderator: Michelle Drostin
9:35-9:55	Clean Water Partnerships Provide Community Outreach and Education to Achieve Reduction in Trash in Washington DC's Waterways-Gary Hopkins, Dennis Chesnut	THE BAY GAME: Balancing Economy, Ecology and Society in the Chesapeake Bay Watershed Mark White-University of Virginia	Educational Outcomes of Restoring Stream Ecosystem Functions-Greg Jennings	Pond Problem Solving: Evolving Opportunities in Stormwater Pond Management Outreach in South Carolina-Guinn Garrett	Citizen Monitoring: Elements of a Successful Program-Harold Harbert
9:55-10:15	Local Conservation Success Stories from Chatham County-Catherine Deininger		Dam Removal: A Guide to Effective Restoration and Prioritization-Erin McCombs	Retrofitting with Urban Street Trees for Stormwater Management Using the Silva Cell Suspended Pavement System-Jonathan Page	
10:15-10:35	The City of Asheville-Cultivating Conservation Through Efficiency-Rachel Harris, Brenna Cook		Regenerative Stormwater Conveyances: Giving Old, Perched Outfalls New Life-Ward Marotti	Innovative Stormwater Floating Islands as Wetland Plant Nurseries-William Lord	
11:00-1:00 World Café General Session, Expo Center					
11:00am	A Possibility Café: Sparking Our Creative Genius				
12:00-1:00	Lunch	Lunch	Lunch	Lunch	Lunch
1:00pm	Adjourn				

## 附件二 與會名單

<u>Name</u>	<u>Company/Org</u>	<u>Job Title</u>
Acharya, Anil	Alabama A and M University	Assistant Professor
Annino, Amy	Collaborative Ecology	Landscape Designer
Arkie, Loren	Pueblo of Laguna	Environmental Technician
Atkinson, Michelle	Manatee County Extension Service	Environmental Horticulture Agent
Bagwell, Elizabeth	UNC Asheville	Vice Chancellor for University Advancement
Barry, Michael	UT Extension	
Bauer, Mace	UF/IFAS Extension Columbia County	Agronomy & Commercial Horticulture Extension Agent III
Beadles, Samuel	Southern Polytechnic State University	Chair and Prof Civil & Construction Egr Dept
Berthold, Allen	Texas Water Resources Institute	Project Specialist
Borisova, Tatiana	University of Florida	assistant professor
Bottoms, Sandy	Bluegrass Greensource	
Brantley, Eve	Auburn University	Assoc Professor, Extension Specialist
Brennan, Amanda	Carolinas Integrated Sciences & Assessments	Climate Outreach Specialist
Brinks, Rachel	Alabama Cooperative Extension System	Administrator I, Outreach Programs
Brown, Jessica	Georgia State University	Students
Bryant Cheney, Ashley	Bluegrass Greensource	Green Job Coordinator
Caddell, Emily		Watershed Resources Coordinator
Cafilisch, Mary	Clemson University Extension	Water Resources Agent
Caldwell, Lynn	New River Conservancy	Restoration Director
Carbone, Greg	University of South Carolina	Professor of Geography
Carnevale, M.J.	City of Winter Haven/Natural Resources Division	Natural Resources Project Coordinator
Carnevale, Shannon	University of Florida IFAS Extension Polk County	Natural Resources Extension Agent
Carper, Kenneth	Stantec	Water Resources Team Lead
Casse, Leslie	McCullough Institute at UNC Asheville	Director
Cassell, Chelsie		
Chandler, Dena	Equinox	Environmental Designer
Chestnut, Dennis	Groundwork Anacostia River DC	
Clapp, Roger	Watershed Association of the Tuckasegee River	Executive Director
Clark, Paul	NC DENR-DWR Water Planning Section	Env.Prg Consultant
Clift, Jonathan	Wake Forest   CEES	Associate Director of Outreach
Colavito, Daniel	Town of Holly Springs	Environmental Technician
Contorno, Mark	Creeklife.com	Founder
Cook, Brenna	City of Asheville	
Counts, Kimberly	Clemson Extension Service	Water Resources Extension Agent
Davis, Kimberly	Florida A&M University	Environmental Education Coordinator
De Vries, Erin	Lake Champlain Sea Grant/University of Vermont	Aquatic Science Literacy Educator
DeBruyn, Jennifer	University of Tennessee	Assistant Professor
Deiningner, Catherine	Biocenosis LLC	Environmental Scientist
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