



**CUAHSI STRATEGIC PLAN**  
2018 – 2023

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Executive Director

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# ACKNOWLEDGEMENTS

CUAHSI and its Board of Directors thank CUAHSI Members, Representatives, and the many members of our community who have been invaluable contributors to CUAHSI's mission. We are grateful to all the people from the academic, federal, non-profit, and private sectors who have provided input and guidance on this plan.

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Water science will play an increasingly important role for the benefit of humanity during the next decades, as water will be the key to ensuring adequate food and energy resources for future generations...The increasing pace of environmental changes calls for a better understanding of hydrology...With such a premise, it is not surprising that the discipline of hydrology, which is rooted in engineering to solve real water problems, emerged in the last 50 years as a primary field of geosciences. It is now called upon to integrate across an enlarged interdisciplinary water science with fields such as geography, social sciences, public health, engineering, and advanced monitoring technologies to solve an increasing number of water sustainability problems.

Montanari et al., 2015, WRR 51:6797-6803

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We add special thanks to members of the CUAHSI 2017 Board of Directors and CUAHSI leadership who participated in a strategic planning retreat. The leadership of Cindy Zook, Cindy Zook Associates, was invaluable in developing this plan. The continued financial support of the National Science Foundation (NSF) and our other partners is gratefully acknowledged.

We hope that you find this plan compelling and we solicit your feedback, as well as continued participation in the CUAHSI community.

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Many researchers from the community believe that the activities of CUAHSI have led to a spirit of cooperation in determining how groups can better work together to enhance the field in terms of knowledge generation and sharing. In particular, smaller universities with limited resources have had opportunities made available to them that would typically not otherwise be easily obtained...Having a “community voice” is anticipated to foster exchanges with similar international community-wide entities and thus advance efforts in building shared research infrastructures (physical and computational) that will enable and facilitate a global water science research and education perspective.

National Research Council, 2012, Challenges in Opportunities in the Hydrologic Sciences

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# INTRODUCTION

Water is essential to life. Water is essential to a robust economy and a healthy environment. In scientific literature, popular press, and through the actions of organizations worldwide, we are seeing a growing appreciation for the value of water. One might easily argue that all seventeen of the United Nation's Sustainable Development Goals are dependent on ready access to clean water. For the last four years, the World Economic Forum (2018) has identified water crises as one of the top five global risks in terms of impact. The other four risks in the top five, which are extreme weather, major natural disasters, failure of climate change adaptation, and large-scale involuntary migration, all have connection to water issues. In a rapidly warming global climate, "Water is the primary medium through which climate change influences Earth's ecosystem and thus the livelihood and well-being of societies" (UN Water, 2010). This array of water challenges requires a multi-disciplinary community approach to identify scientifically sound solutions and to support infrastructure that enables discovery and communication of this information.

The Consortium of Universities for the Advancement of Hydrologic Science, Inc. (CUAHSI) was established in 2001 as a 501(c)(3) non-profit corporation. Since then, CUAHSI has evolved to meet the changing needs of the water science community, to reflect the landscape of federal science funding, and to respond to technological innovations. CUAHSI has been successful in developing water data services that are innovative and robust, and community services that are well-received and often over-subscribed. Looking forward, CUAHSI is committed to continuous improvement and expansion of both its water data services and its education/outreach services to meet new demands and opportunities, including community modeling, and to continue to build a multi-disciplinary community for hydrologic sciences. This will require that CUAHSI continue to take advantage of opportunities emerging from the National Science Foundation (NSF) and to simultaneously nurture new and existing partnerships that the community requires.

Hydrology is by nature interdisciplinary, as water moves through, on, and above Earth's surface. Water mediates and affects biogeochemical reactions, supports ecological systems, supports economic development, and provides humans with life. CUAHSI members and activities span multiple NSF directorates and depend on science being developed across the Foundation. This interdisciplinary nature of hydrologic sciences is a fundamental strength of CUAHSI, offering both a challenge and a tremendous opportunity, as CUAHSI serves the broad water-resources science and engineering community.



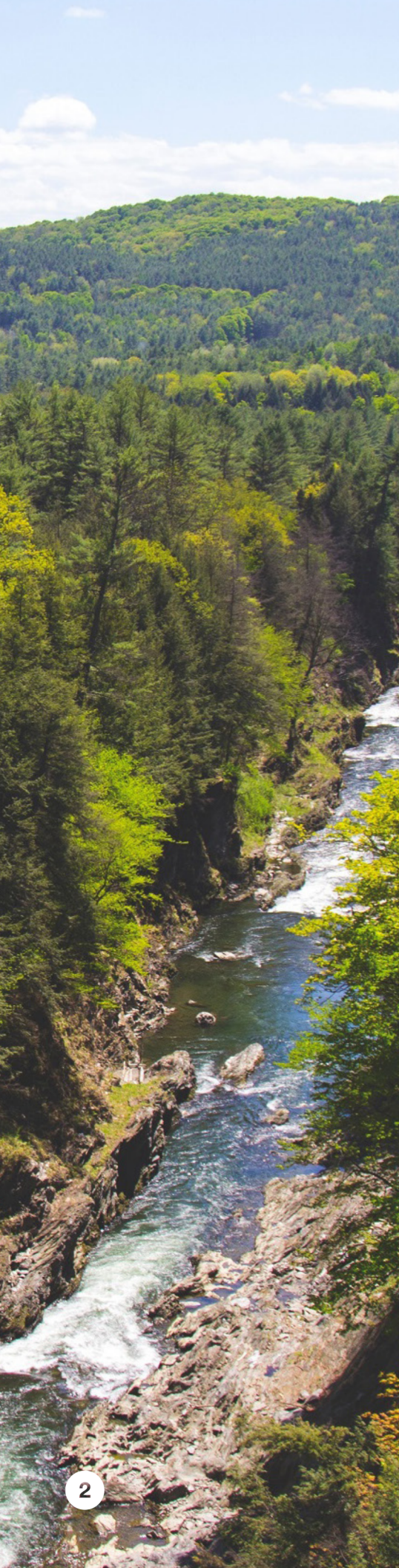
With the advent of [CUAHSI's water data] services, the amount of time dedicated to finding data is minimized, making more room for in-depth analysis of water patterns.

A user of CUAHSI's Water Data Services



CUAHSI underwent an NSF management review in early 2017. Outcomes from that review inform this strategic plan, as does input from the community. The Board of Directors and CUAHSI leadership met for 1.5 days later in 2017, in a facilitated strategic planning retreat. Results of that meeting formed the foundation of this plan. Members of the water science community, including our Standing Committees, were solicited to provide inputs on opportunities and challenges for CUAHSI in the coming five years. These comments provided valuable input for the workshop and this plan. Our members and others also provided important input on the final draft of this plan.





# OUR VISION AND MISSION

**A multidisciplinary, dynamic scientific community enabled by shared resources developing an integrated understanding of water, earth, ecosystems, and society sufficient to ensure an adequate water supply for human and environmental needs and to prevent human exposure to water hazards today and in the future.**

CUAHSI's vision today is consistent with our vision articulated in the 2010 – 2015 Strategic Plan and earlier, while recognizing the increasing importance of hydrologic science to both water availability and water hazards in a changing world. Our vision acknowledges the interdisciplinary nature of the science needed to ensure safe and sustainable water resources into the future. We also understand that the key to understanding water in its multitude of contexts requires investments in science, engineering, technology, and data and modeling infrastructure shared across the community to address the complex, inter-related water issues. This vision has guided us since 2001 and will continue to do so in the future.



CUAHSI has helped bring together a very diverse field. Most of us have seen firsthand many of the scientific products from approaching important problems collaboratively from different perspectives. There are many incredible folks involved that devote so much time to a discipline we all love.

Assistant Professor in CUAHSI newsletter interview



**CUAHSI's mission is to advance water science by strengthening interdisciplinary collaboration in the water science community, to empower the community by providing critical infrastructure, and to promote education in the water sciences at all levels.**

We accomplish our mission by supporting our member institutions and the broader water science community through

- Promotion of science excellence and innovation;
- Development and management of unique community resources and services;
- Creation and nurture of productive collaborations and partnerships; and
- Expansion of educational opportunities.

# VALUES : WHO WE ARE

Our core values inform internal and external interactions. CUAHSI is committed to the advancement of hydrologic sciences through our Water Data Services and our Community Services. We value our staff, our members, and our collaborators. We strive to be strategic collaborators, innovative catalysts, and impactful leaders.

## Strategic Collaborators

We value the contributions of others and look for ways to strengthen the hydrologic sciences community.

We respond to our community's needs.

We build bridges across institutions so that the sum is greater than the parts.

We value our colleagues at CUAHSI.

## Innovative Catalysts

We work to bring new ideas, technologies, and science to the community and into practice.

We pursue creative use of technology and bring innovation to the community.

We are accountable to high standards of academic, professional, and business excellence.

## Impactful Leaders

We are passionate about working for the greater good to advance water science.

We deliver relevant, high value services and tools that make a positive difference.

We are actively engaging and supporting the community to drive lasting change.



## CORE VALUES

Technical Excellence

Objectivity

Service to Society

Collaboration

Transparency

Democratic Governance

Support for Both Individual and Team Science

Community Action



# GOALS:

“The CUAHSI community and learning opportunities offered has the potential to give your water-related research a jump-start. The organization encourages collaboration and developing strong professional networks. The short courses offered are of extremely high quality.”

Graduate student in CUAHSI newsletter interview

# OUR FOCUS FOR THE NEXT 5 YEARS

**CUAHSI's priorities and actions over the coming five years will be guided by four strategic goals. These goals are each supported by objectives, some of which are short-term, and others of which will take several years to achieve.**

CUAHSI's strategic goals are aligned with those of the NSF and NSF's Geosciences Directorate (GEO). NSF's "Ten Big Ideas for Future Investments" includes "Harnessing Data for 21st Century Science and Engineering" and "Growing Convergent Research." CUAHSI's Water Data Services help ensure that water data of all types are readily archived, published, and discoverable, thus facilitating their future use in research, while also meeting federal requirements for data publication. As NSF notes, one of today's

grand challenges is understanding the food, energy, water nexus; CUAHSI's multidisciplinary approach to water science significantly advances those convergent research activities. CUAHSI's strategic goals clearly are supportive of GEO's Imperatives in Research (water cycle understanding); Community Resources and Infrastructure (state-of-the-art facilities); Data Cycle and Cyberinfrastructure (all aspects); and Education and Diversity (community resources for research and education).

## GOAL 1

**Promote discovery in the water sciences through leadership in water data services in support of interdisciplinary collaborative research.**

## GOAL 2

**Foster and facilitate the integration of hydrologic science research and data services into innovative, multi-disciplinary educational and community building activities.**

## GOAL 3

**Grow and diversify CUAHSI partners and funding sources to ensure sustainability of services through a multi-disciplinary approach.**

## GOAL 4

**Increase the visibility, reach, and reputation of CUAHSI in the diverse water community.**

# GOAL 1

## Promote discovery in the water sciences through leadership in water data services in support of interdisciplinary collaborative research

CUAHSI provides access to time-series data through the Hydrologic Information System (HIS) and other types of hydrologic data through HydroShare. CUAHSI's HIS time-series catalog now contains information for 93 unique data providers, at 735,000 sites, with 433 billion water observations. HydroShare offers users the ability to archive and publish all types of water data, including GIS coverages, remote-sensing images, and model output. Collaboration among scientists and model applications in a virtual environment also are possible. These services also provide users an ability to archive and publish data to enhance trust in research findings through transparency and reproducibility, and to enable reuse, thereby leveraging the value of research investments and promotes further discovery through integration of information from multiple sources. Use of these services continues to grow as new features are added and as CUAHSI broadens outreach and educational efforts.

CUAHSI's Water Data Services fill a unique niche in the hydrology community. For example, the continued development of technology specifically geared to sharing and publishing water data fills an important need for researchers operating in the NSF WSC (Water Sustainability and Climate) and INFEWS (Innovations at the Nexus of Food, Energy, and Water Systems) community, who are required to publish their data. CUAHSI's Water Data Services also can help support other NSF activities with hydrologic components, such as the Critical Zone Observatories (CZOs), NEON (National Ecological Observation Network), and LTER (Long-Term Ecological Research), and provide the community with seamless access to data through CUAHSI Water Data Services.

CUAHSI continues to be involved with the development of HydroShare to enhance its utility to the academic research community. This includes the addition of collaboration and other social features; the ability to publish models and specific applications of models as well as data; and the development of visualization tools. CUAHSI is also working with CZOs to provide field data management support for simplifying data publication and providing better data management to scientists as the quantity of sensor data increases. These examples demonstrate how CUAHSI leverages the results of NSF investments in cyberinfrastructure development to benefit the hydrologic science community.



I learned about CUAHSI Data Services in the American Geophysical Union 2015 meeting. Immediately I knew that they could help with my hydrology data.

A user of CUAHSI's Water Data Services



CUAHSI's data services also support community modeling through ready data access and applications that facilitate real-time collaborative modeling, as well as workflow documentation thereby ensuring repeatable science. Opportunities for community modeling should only increase as continental- and regional-scale modeling capabilities grow. Nevertheless, CUAHSI applications and products operated through HydroShare can enable a variety of hydrologic modeling activities.



## OBJECTIVES

Understand user requirements through continued engagement with the community and CUAHSI's Standing Committees.

Provide avenues for enhanced community modeling, including data services to support modeling and collaborations on modeling governance.

Ensure that CUAHSI Water Data Services support the complete life cycle of data management from collection, quality control and analysis, to archival, publication, discovery, and reuse.

Ensure that CUAHSI Water Data Services are a recognized repository for scientific journals, federal programs, and other community users.

Provide new data services, including social network and sensor data management tools, to meet emerging demands.

Grow access to federated data services through CUAHSI Water Data Services.



**Foster and facilitate the integration of hydrologic science research and data services into innovative, multi-disciplinary educational and community building activities**



CUAHSI supports the water science community, not only through water data services, but also through the integration of research into innovative multi-disciplinary educational and community building activities. These activities are done in partnership with academic institutions or agency partners, so that CUAHSI funds are heavily leveraged to provide these services. Because CUAHSI provides opportunities that generally are unavailable from any single institution, CUAHSI's community services invariably are oversubscribed.

CUAHSI has some great opportunities to provide courses to underfunded graduate students.

CUAHSI Pathfinder Fellow

Work in support of Goal 2 will continue and grow the activities of the past several years. During 2009 – 2017, CUAHSI hosted 24 workshops or short courses, training 634 participants from 234 distinct institutions. CUAHSI regularly hosts cyberseminars series (3 – 5 individual seminars on a topic), which are archived on CUAHSI's YouTube Channel, and have averaged more than 1,000 views per year since 2010. CUAHSI's three 2017 cyberseminar series averaged more than 200 registrants per series. CUAHSI has awarded 25 Instrumentation Discovery Travel Grants since 2015, and 58 Pathfinder Fellowships since 2009, with awardees from 43 distinct universities. In 2017, CUAHSI piloted the CUAHSI Virtual University, which is a unique multi-institutional graduate course to increase delivery of the latest research to students.

CUAHSI's partnership with the National Weather Service in hosting the Summer Institute at the National Water Center is aligned with Goal 2 and has been a tremendous success. Starting in 2015, this annual event has involved 33 university faculty, staff from more than 15 organizations, and 133 students from 67 distinct institutions during the seven-week institute in 2015 - 2018. In addition to advancing the National Water Model and providing a unique training opportunity for students, the Institute offers an opportunity for workforce development for the National Weather Service.

**OBJECTIVES**

Aggressively pursue funding opportunities for water-data driven educational activities.

Expand the CUAHSI Virtual University.

Provide Summer Institute opportunities in partnership with other organizations.

Expand training to involve agencies and the private sector.

Increase engagement with academic partners through remote or on-site seminars to promote CUAHSI water data and community services.

Integrate CUAHSI Water Data Services into Community Services.



# GOAL 3

## Grow and diversify CUAHSI partners and funding sources to ensure sustainability of services through a multi-disciplinary approach

The sustainability and growth of CUAHSI requires new partnerships that include collaboration, use of CUAHSI services, and funding. In recent years new and growing partnerships with NOAA (National Oceanic and Atmospheric Administration), NCAR (National Center for Atmospheric Research), NASA (National Aeronautics and Space Agency), and DHS (Department of Homeland Security), as well as involvement in the Aspen Institute's Internet of Water have helped extend CUAHSI's visibility and impact. New partnerships mean that CUAHSI can bring a more diverse set of skills and services to the community and address water-science problems from multiple perspectives. Meaningful partnerships will ensure that CUAHSI's services will see greater usage and acceptance, and that opportunities for support will grow.



The Summer Institute is an invaluable opportunity for beginning-career hydrologists. I cannot overstate the amount I learned, the increase of confidence in my abilities, introduction to new concepts and methods, and the relationships that I formed during the SI.

Participant of National Water Center Innovators Program: Summer Institute



An increasingly important role of CUAHSI, particularly through the Summer Institute and through HydroShare capabilities, is the support of community modeling. For example, the National Water Model, which CUAHSI is supporting through various apps and services, is one of several regional to continental scale hydrologic models. CUAHSI also already supports USDA's SWAT model through a HydroShare app, and will investigate other opportunities to support community modeling. Access to CUAHSI's data services in conjunction with the collaborative modeling capabilities of HydroShare offers many opportunities for scientific advances through CUAHSI's leadership.



## OBJECTIVES

Expand CUAHSI post-doctoral appointments in partnership with federal agencies to support CUAHSI priorities while meeting agency mission goals.

Capitalize on the success of the Summer Institute to gain new partners in similar activities.

Educate the broad water community (Federal and State agencies, volunteer monitoring organizations, water utilities, and non-profits) about CUAHSI's services and seek ways to support their needs.

Support cross-sectoral community modeling efforts.

Seek opportunities to monetize CUAHSI's Water Data Services.

Develop and report on metrics to demonstrate value of CUAHSI's services and to identify sectoral opportunities.



Increase the visibility, reach, and reputation of CUAHSI in the diverse water community



OBJECTIVES

Ensure that CUAHSI's Water Data Services are convenient to utilize by users with a full range of skills.

Increase CUAHSI member institutions.

Develop and implement a strategic marketing and outreach plan.

Ensure that all CUAHSI's services are properly branded.

Increase CUAHSI acknowledgements in the peer-reviewed literature.

Utilize CUAHSI Board of Directors and CUAHSI alumni as effective ambassadors for CUAHSI services.

Increase direct engagement of CUAHSI staff with the user community through seminars, workshops, conferences, etc. to increase visibility and to provide training.



CUAHSI programs have been a foundation for my graduate education. They have given me the opportunity to build a background, academic relationships, and friendships that would have taken years if not longer to generate on my own and have generously provided the educational, organizational, and financial resources necessary to stay involved and keep learning.

Graduate student in CUAHSI newsletter interview



CUAHSI needs to increase its visibility within the hydrologic sciences community and beyond in order to meet its first three strategic goals. In surveys taken at CUAHSI-sponsored training workshops and short courses during the last three years, many participants were unaware of the existence of CUAHSI and its role in the hydrologic sciences community, although there is strong support for the organization once individuals are introduced to the opportunities. There clearly is a need to make a more concerted effort to brand CUAHSI's services and to ensure that these services are broadly known and accessible within the hydrologic services community. Further, CUAHSI needs to ensure that the multiple services and tools are described clearly and properly branded to ensure their value is appreciated.



The one thing I've learned that I would not have gotten were it not for CUAHSI was the exposure to the larger overall academic structure and culture, which you simply do not get exposed to in your own university as a graduate student, and really informed my choice to peruse academia.

Graduate student in CUAHSI newsletter interview



CUAHSI actively supports collaborative learning and if you put yourself out there, you'll make some of your best friends, produce great research and have a blast doing it.

Graduate student in CUAHSI newsletter interview



# CUAHSI MEMBERS : 2018

## University Members

Auburn University	Ohio State University	University of Kentucky
Boise State University	Oregon State University	University of Maryland - Baltimore County
Brigham Young University	Pennsylvania State University	University of Memphis
Carnegie Mellon University	Princeton University	University of Miami
Clemson University	Purdue University	University of Minnesota
Colorado School of Mines	Rutgers University (SUNJ)	University of Montana
Colorado State University	South Dakota State University	University of Nebraska
Columbia University	Southern Illinois University	University of Nevada - Reno
Cornell University	Stanford University	University of New Hampshire
Dartmouth College	State University of New York - Buffalo	University of New Mexico
Drexel University	State University of New York - ESF	University of North Carolina System
Duke University	Syracuse University	University of North Dakota
George Mason University	Temple University	University of Notre Dame
Georgia Institute of Technology	Texas A&M University	University of Pittsburgh
Georgia State University	Tufts University	University of South Florida
Harvard University	University of Alabama	University of Tennessee
Idaho State University	University of Alabama - Huntsville	University of Texas - Arlington
Indiana University	University of Alaska - Fairbanks	University of Texas - Austin
Iowa State University	University of Arizona	University of Texas - San Antonio
Johns Hopkins University	University of Arkansas	University of Utah
Kansas State University	University of California - Berkeley	University of Vermont
Kent State University	University of California - Davis	University of Washington
Louisiana State University	University of California - Irvine	University of Wisconsin - Madison
Marquette University	University of California - Merced	University of Wisconsin - Milwaukee
Michigan State University	University of Central Florida	University of Wyoming
Mississippi State University	University of Colorado - Boulder	Utah State University
Montana State University	University of Connecticut	Vanderbilt University
Murray State University	University of Delaware	Virginia Tech University
New Mexico State University	University of Florida	Washington State University
New Mexico Tech	University of Georgia	West Virginia University
Northeastern University	University of Hawaii	Woods Hole Oceanographic Institution
Northern Arizona University	University of Illinois	
Northwestern University	University of Iowa	

## Affiliate Members

Albion College	Queensland University of Technology	University of Ljubljana
Centre for Ecology and Hydrology	RTI International	University of New Brunswick
CIMA Research Foundation	Smith College	University of Padova
Cleveland State University	Smithsonian Environmental Research Center	University of Quebec
Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia	Stockton University	University of Queensland
Dalhousie University	Stroud Water Research Center	University of Saskatchewan
Desert Research Institute	Suez Canal University	University of Sidi Mohamed ben Abdellah
Eastern Illinois University	Swedish Hydrological Council (SHR)	University of Trento, Italy
Indian Institute of Technology Kharagpur	UNESCO - IHE Institute for Water Education	University of Waterloo
McMaster University	Universidad de las Americas Puebla	University of Zurich
Pacific Geographical Institute	University of British Columbia	Yonsei University
Plymouth State University	University of Calgary	
	University of Copenhagen	