THE UNIVERSITY OF ALABAMA® | Alabama Water Institute

NEWSLETTER Volume 2 No. 4

COMBATING THE HARMFUL EFFECTS OF ILLICIT SUPPLY NETWORKS

A recent workshop co-hosted by the Alabama Water Institute aims to shed light on the growing problem of illicit supply networks, or ISNs. These networks pose numerous risks to national security, human and environmental health and economic prosperity.

By Brock Parker

According to researchers, established ISNs on the radar of law enforcement conduct activities such as trafficking cocaine, wild flora and animals. However, new ISNs are being discovered, such as the illegal mining of sand. These emerging networks don't often attract attention from authorities, but they are the cause of many social and environmental damages. Since little is known about how these ISNs operate, how big they are and exactly how much socio-environmental destruction they create, combating them can be a daunting task.

Photo caption (from left to right):
Front row: Konrad Piepke, Odean Sorrano, Nicholas Magliocca, Beth Tellman, Kendra McSweeney, Tara Easter, Annette Hubschle, Ines Quiroz, Aurora Torres, Silvana Croope Back row: Neil Carter, Meredith Gore, Aunshul Rege, Kevin Curtin

To better understand and begin finding a solution to these problems, the workshop brought together 16 domestic and international researchers to The University of Alabama. It was the first of its kind to comparatively analyze these networks and pull together the limited knowledge about them.

"The breadth and diversity of expertise of the group allowed us to make connections that have yet to be recognized in mainstream knowledge or academic research," said Dr. Nicholas Magliocca, lead workshop organizer and assistant professor in UA's Department of Geography. "The challenge of finding commonalities and differences among the illicit cocaine, wildlife and sand trades made each of us look at our own ISNs of interest in a new light."

Researchers have identified several of the societal and environmental harms from these networks. Deforestation and expansion of agrobusiness by way of money laundering and territorial control stems from trafficking cocaine. Wildlife trafficking is also associated with money laundering, but includes corruption and altered food web relationships. Illegal sand mining is linked to localized impacts on erosion, hydrology, groundwater recharge and illegal immigration.

Despite the differences in the unique problems they each create, they all share a mutual factor.

"All ISNs were associated with a suite of social harms ranging from violence, intimidation and corruption to exacerbation of existing rural problems such as addiction, domestic violence and food insecurity," Magliocca said.

One of the takeaways from the workshop focuses on the relationship between ISNs and their disruptions. The primary interruptions of their operations occur through law enforcement, market factors and regulations. When the networks encounter these obstacles, they begin to seek out other ways to grow. Group members studied these changes and were able to develop a common conceptual framework among all ISNs, which will help determine their potential courses of action and create the means to fight them.

"The workshop enabled us a unique opportunity to delineate the spatialized similarities and differences between the nature of production and the nature of consumption for cocaine, wildlife and sand," said Dr. Meredith Gore, associate professor

(continued on next page)

(continued from previous page)

in the Department of Fisheries and Wildlife at Michigan State University. "These process insights inform how comparative research on ISNs can enhance the capacity of individual research communities to leverage their science more effectively."

The researchers believe the strategies from the workshop will help make people from all walks of life aware of these threats and how their adaptations to law enforcement play a central role in social and environmental damages.

"The workshop highlighted the power of interdisciplinary scholarship, with participates exchanging new ideas to synthesize insights on understanding and addressing the globally ubiquitous issue of ISNs," said Dr. Neil Carter, assistant professor at the University of Michigan's School for Environment and Sustainability.

The University of Alabama was represented by researchers affiliated with the Department of Geography, the Department of Criminology and Criminal Justice and the Alabama Transportation Institute.

The workshop was co-sponsored by AWI, ATI and the College of Arts & Sciences.

The undergraduate and graduate students participate in the autonomous underwater vehicle test at Palmer Lake on The University of Alabama campus.

SONG DEVELOPING NEW UNDERWATER COMMUNICATION TECHNIQUES

Dr. Aijun Song is an assistant professor of electrical and computer engineering in The University of Alabama's College of Engineering. He received his Ph.D. from the University of Delaware, and his area of research is underwater wireless communications.

By Brock Parker

Two Eco-Mappers from YSI in Dr. Song's lab. The new one, seen in front, was purchased using the NSF MRI fund.

"I always wanted to be a scientist or engineer when I was younger," said Song. "After I completed my Ph.D. in electrical engineering, I had the opportunity to apply what I learned to solve communications problems in the ocean."

Song is working on several projects, all of which aim to develop new communication techniques in aquatic environments. For example, he is collaborating with the University of Houston to discover how to use existing underwater oil pipelines for data communications and subsea infrastructure and structure health monitoring. Song said thousands of miles of pipelines crisscross the floor of the Gulf of Mexico, and they are still trying to find ways to take advantage of the existing pipelines to address the communication challenge in the ocean.

One of Song's other projects is working with Georgia Tech to develop mobile sensor networks to support underwater data collection and environmental monitoring.

"The idea is to use mobile platforms, both autonomous surface vehicles and autonomous underwater vehicles, to alleviate communication difficulties," he said. "At the same time, the developed communication capability can enhance monitoring or survey missions of these autonomous vehicles because communications supports coordination among them."

Song said even though finding solutions to these issues are challenging, they are exciting projects driven by new ideas and technologies. By collecting data and measurements through instrumentation and field work, he said they are developing new algorithms and protocols to build these new lines of communication. However, his discoveries could also lead to other uses.

"In the next step, I plan to work with scientists or faculty from environmental science disciplines to see how we can utilize the tools that I process or have developed in different applications," said Song. "For example, water quality surveys, sampling of nutrients or pollutants in aquatic environments."

Song said these collaborative efforts with multiple external research units, including the University of Delaware and Dauphin Island Sea Lab, can bring a wealth of knowledge back to UA.

"In particular, the mobile sensor network infrastructure that is under development will provide cutting-edge tools to expand the research of the Alabama Water Institute."

USING MODELS TO REDUCE THREAT OF NATURAL DISASTERS

Dr. Jongkwan Kim is a visiting scientist to the Alabama Water Institute from the University Corporation for Atmospheric Research. His expertise focuses on hydrology, primarily distributed land surface, hydrological and hydrometeorological modeling. His interest in these areas helped bring him to Tuscaloosa.

By Brock Parker

Dr. Jongkwan Kim

"Water is an important resource for all living life, and The University of Alabama has done much research on water," said Kim. "Many departments in and around the University, including the National Water Center, have hired various fields of professors and researchers for water research."

In recent years, Kim has been studying the National Water Model, or NWM, which is a new distributed hydrologic model of NOAA's National Weather Service.

"I compared the performances of HL-RDHM, an initial distributed hydrologic model of NOAA-NWS and NWM over six river forecasting centers," he said. "I have also participated in the project of 'Demonstration of Hyper Resolution Modeling of Urban Flooding' to generate valuable street-level inundation flood maps at the request of the U.S. Congress."

In that project, he applied the WRF-Hydro model, an open-source community model and the core of the NWM, on a highly urbanized area with high spatial and temporal resolution. He analyzed the streamflow and maximum water depth simulations with U.S. Geological Survey streamflow observations and noted high water marks from field surveys and social media.

Finally, he participated in an ongoing NWM improvement project, which helps strengthen the land surface and hydrologic processes within that model. He investigated computer codes within the NWM to advance the mathematical and physical representations.

The outcomes for these projects come down to a singular goal.

"Many people suffer from natural disasters, such as floods and droughts every year, and I want to minimize the damage caused by water through accurate modeling, observing and forecasting," said Kim. "Through the NWM and its improvement, I want to make better predictions and eliminate the risk of natural disasters."

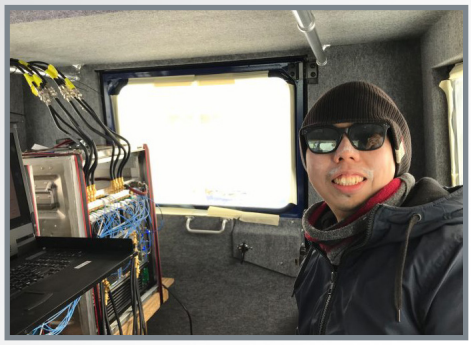
In addition to his continued work on the NWM, he wants to analyze the impact of human activities, like dam or reservoir construction, on changes in surrounding climate, land cover, ecology and vegetation. Kim sees these ideas and his experience at UCAR and the NWC as opportunities to further strengthen collaborations on campus.

"I would like to develop projects to integrate multiple departments and our AWI centers within UA," he said. "My philosophy is to think interdisciplinary, how I can integrate a diverse team, to approach traditional and non-traditional projects."

To meet Kim and discuss collaboration efforts, he can be contacted at jkim191@ua.edu.

The Alabama Water Institute is currently seeking guests for its new podcast. Take advantage of this opportunity to promote your research to a wider audience. **Contact Brock Parker at brockparker@ua.edu or 205-348-5328** for more details or to schedule a recording.

UA RESEARCHERS CONTINUE GROUNDBREAKING WORK IN GREENLAND



Dr. Stephen Yan was part of a crew of UA researchers who worked in Greenland this summer.
(Photo courtesy of Dr. Charles O'Neill)

For the second consecutive year, a team of researchers from The University of Alabama traveled to the Arctic Circle to help unveil ancient climate history and provide perspectives on improving climate models.

The researchers from the Remote Sensing Center in the UA College of Engineering were on the ice in northern Greenland as part of an international project to study the North East Greenland Ice Stream. They spent part of the summer conducting radar measurements and testing new radars to map the ice sheet's bed and ice layers.

"Our role in this project is really remote sensing technology in ice-penetrating radar that has been developed by our faculty and students," said UA President Stuart R. Bell. "They are able to see through the glacial ice."

Bell and his wife, Susan, visited the research site at the invitation of Professor Dorthe Dahl-Jensen at the University of Copenhagen. She's the leader of the project examining the behavior of the ice sheet.

"The purpose of the trip was to see The University of Alabama at work and our researchers collaborating in a very international setting," Bell said. "It's always enlightening to see that level of research being conducted and discussed and seeing The University of Alabama serving a critical role in that research."

It is uncertain how much glaciers and ice sheets will influence rising seas because scientists are not quite sure how they behave, contributing to considerable uncertainty in predictions of future sea levels. The Alabama work aims to provide clarification.

Engineering researchers at UA developed a unique radar to provide an accurate image of what occurs at the base of the ice. The radar is the first of its kind, advancing the use of a type of radar known as ultra-wideband surface-based radar for scanning the interior of ice.

Dr. Siva Prasad Gogineni, Cudworth Professor of Engineering and director of the UA Remote Sensing Center, is lead UA engineering researcher on the project and is an internationally recognized expert in the field of remote sensing.

A UA team went in 2018 and again in 2019. This year's field team was Dr. Stephen Yan, assistant professor of electrical and computer engineering; Dr. Sevgi Zubeyde Gurbuz, assistant professor of electrical and computer engineering; and Dr. Charles O'Neill, research engineer.

HOW TO GET AFFILIATED WITH THE ALABAMA WATER INSTITUTE

If you have expertise that could contribute to addressing complex water issues, please register yourself on our website. All registered members are considered affiliated with AWI and have access to all AWI resources. To register, visit the AWI website: ***awi.ua.edu.***

Affiliated Member Information:

http://awi.ua.edu/awi-affiliated-members/

Eligibility Criteria:

- A faculty/staff/student appointment at the University of Alabama.
- Research expertise in a water-related field.
- Completion of registration form.

Questions? Please contact Stefanie O'Neill at soneill2@ua.edu or 205-348-9128.

Alabama Water Institute Newsletter
Vol. 2 No. 4

Director: Dr. Patty Sobecky
Designer: David Galinat
Writer: Brock Parker

THE UNIVERSITY OF ALABAMA®