LandSAGE4[1] – Smart Collaborative Decision Support for Monitoring and Mitigation of Natural Disasters

Data Visualization for Natural Disasters

Data visualization is the process of turning data into imagery to produce insight. In the age of data-intensive science and engineering, visualization is crucial for revealing the meaning behind the data, and then communicating these findings to policymakers and everyday citizens. Data-intensive applications have been the key to solutions to natural and human problems, leading to success in research and discovery. This is especially critical for research on environmental topics, such as understanding and mitigating natural disasters, and climate change, which involve a range of societal responses to social and behavioral issues.

According to the Asian Disaster Reduction Center, 5,634 disasters affecting an estimated 6.5 billion people were recorded in Asia between 1975 to 2020. Lower Mekong in Southeast Asia is regarded as one of the most disaster-prone areas in the world. The Lower Mekong Basin, feeding over 65 million people from Cambodia, Laos, Vietnam, and Thailand, is regularly affected by natural disasters such as floods, typhoons, droughts, and landslides. The Mekong River Commission estimated that the costs of damages and losses from floods reached up to USD 200 million per year between 2010 and 2014. Beyond financial costs, natural disasters can have catastrophic and often irreparable ecological repercussions on the surrounding environmental resources, downstream habitats, and wildlife.

Project Overview

The LandSAGE4 project (landsage.info) focuses on developing and demonstrating a revolutionary approach to natural disaster management using data and visualization-rich decision support built on networked cyberinfrastructure. Disaster data are displayed and analyzed on CyberCANOEs (ultra-high-resolution display walls) using SAGE3 and LandSAGE visualization software. These technologies allow researchers, both collocated and remote, to combine large volumes of data in the form of visualization so decisions can be made quickly and confidently. The project initially focuses on floods and landslides in the Lower Mekong Basin. CyberCANOE and SAGE3 are two of the National Science Foundation's premiere collaboration hardware and software platforms for Big Data.

LandSAGE software running on CyberCANOEs (Photo taken at Mahidol University)
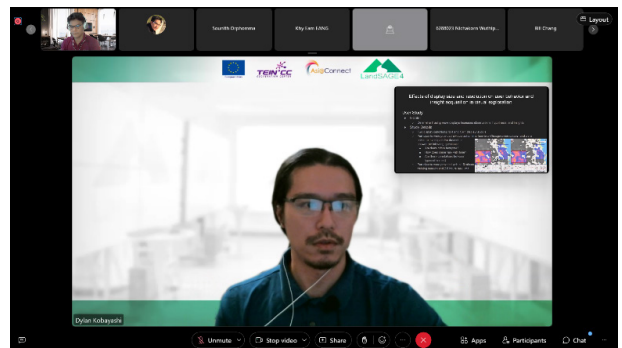
Online lecture on CyberCANOE benefits by Laboratory for Advanced Visualization and Applications (LAVA) Alumnus

---

1) The project has 4 phases to date: LandSAGE1 introduced Southeast Asian researchers to the CyberCANOE (ultra-high-resolution display wall) and SAGE2 technologies. In LandSAGE2, fourCyberCANOEs were deployed to the region. LandSAGE3 leveraged the evolved capability to develop the LandSAGE decision support software and deployed four additional CyberCANOEs. LandSAGE4 develops further on the cyber-infrastructure-enabled visualization capability through software enhancement including a transition to SAGE3 - the latest collaboration tool from NSF, trainings and four more CyberCANOE installations.

The project involves a collaboration between leading scientists at Mahidol University and Thammasat University in Thailand, the Institute of Technology of Cambodia, the National University of Laos and Mekong River Commission Secretariat, Vietnam National University, Universitas YARSI in Indonesia, Advanced Science and Technology Institute in the Philippines, National Institute of Advanced Industrial Science and Technology in Japan, and the University of Hawaii at Manoa in the United States.

LandSAGE4 Impacts

Promoting international collaboration: Since natural disaster is a primary concern of many research institutes, scientists from 10 organizations in 8 different countries join forces to provide better protection against natural disasters through state-of-the-art technologies. LandSAGE4 is contributing to a growing trans-pacific visualization and education collaboration network that serves as a platform for research, education, and innovation for natural disasters and related issues.

Deploying advanced products and services: 4 CyberCANOEs were deployed in Laos, Indonesia and Thailand to provide the necessary cyberinfrastructure for natural disaster management. The LandSAGE software developed in the project has been released in open source so that the Asi@Connect community may take advantage of it for research and educational purposes. Its development focused on adding analytical and simulation capabilities, expansion of disaster monitoring coverage, and usability improvement.

Supporting United Nations' Sustainable Development Goals (11 - Disaster Risk Reduction): The LandSAGE software provides a unique opportunity for improving our understanding of natural disasters. This heightened understanding allows better, more informed decision-making, enabling countries to manage these devastating events more effectively.

Increasing Asi@Connect's network utilization: The deployed CyberCANOEs have increased Asi@Connect's bandwidth utilization as a greater number of science professionals work in the collaborative environmentsmaking sense of natural disaster data.

Enhancing the human capacity of the Asi@Connect partners: Via four physical workshops and four online lectures, around 410 participants from 8 different NRENs received training in using and installing CyberCANOE, SAGE3, LandSAGE software, and other topics related to natural disasters. Female scientists were regularly invited and participated in the training (~32%) to promote gender equality.
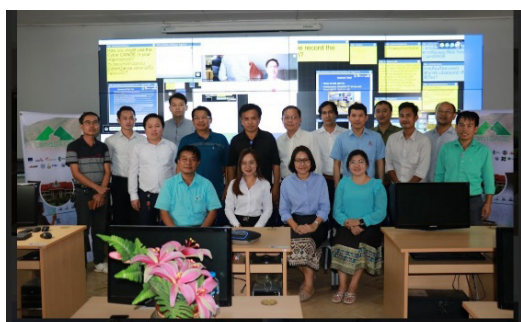
Brainstorming using SAGE3 at National University of Laos

LandSAGE Training at Institute of Technology of Cambodia

FutureWork

In the final workshop in Thailand, the project partners made the decision to work on the next phase - LandSAGE5. Many interesting ideas came up during the discussion including plans to collaborate with a supercomputer center that will provide necessary resources for running large-scale analyses and simulations on natural disaster data, to bring the LandSAGE technologies to local governments and education, and to promote female leadership.

For more information   Asi@Connect : www.tein.asia

European Union

Case Study of **Asi@Connect**