



Khao Yai National Park with 4 almost contiguous protected areas have been enlisted as UNESCO's world heritage site for its rich biodiversity under the name "Dong Phayayen-Khao Yai Forest Complex" since 2005. The park is home to more than 800 species of fauna, covering 6152 sq.km (615,500 hectares) in northeast Thailand. The park is acclaimed for its biodiversity and conservation of globally threatened and endangered species:

- 1 critically endangered specie (Siamese Crocodile)
- 4 endangered species (Asian Elephant, Tiger, Leopard Cat, Banteng)
- 19 vulnerable species.

Over-tourism has brought about many threats to biodiversity from energy use, wastes overfill to GHG emissions and increased carbon footprints from tourism as well as power outage from storms or fallen trees, and illegal logging and hunting.

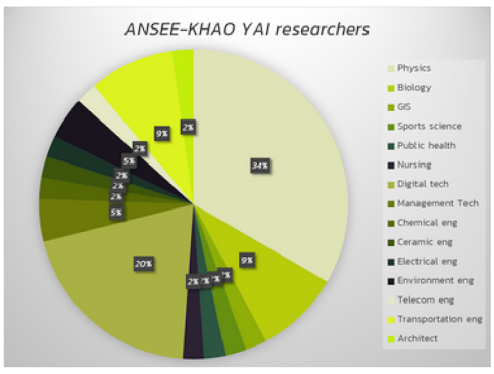
## ANSEE-Khao Yai

With environmental issues from over-tourism, there is imminent threat to the world heritage site status of the national park.

To help alleviate these issues, a large group of researchers across Suranaree University of Technology have thus formed a team under a project called Advanced Nanomaterials for Enhancing Sustainable Energy and Environment in Dong Phayayen - Khao Yai World Heritage (ANSEE - Khao Yai, with the objective to
•To solve energy and environment problems sustainably.

•To encourage change in public behavior and mindsets towards resource and environment conservation.


The above workgroups have been formed from the 11 teams, ranging from renewable energy, environment, tourist behavior and wildlife human conflicts. At the heart of sustainability is to progress forward and to make sure that no one is left behind, we also have a team that aims to promote social strength and quality of living for people in local communities adjacent to the park. Last but not least, we have a coordinating team, to help connect with the stakeholders, local authorities and communities.




## Multidisciplinary team

The project brings together 47 researchers across SUT from science and engineering, social science, digital technology, health science and architect, to share their expertise and contribute to the project outcomes.

# Innovations for Climate Neutral Sustainable Tourism at Khao Yai National Park

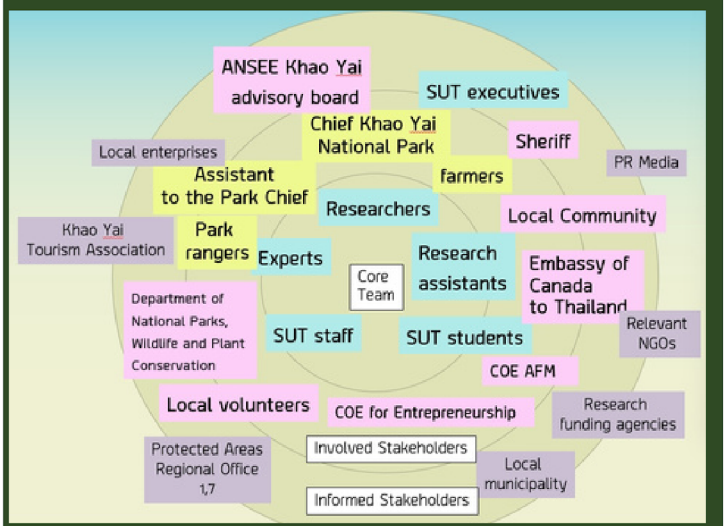
## ANSEE-Khao Yai Advisory Board


The foundation of ANSEE-Khao Yai Project stems from a strong social capital, in which SUT has actively engaged in research and development of "Khao Yai the Valley of Happiness" which is a development of wellness service tourism with local enterprises and communities in the national park area the past. This has brought about a strong advisory board comprising the national park, local authorities and prominent group leaders in the region.

The stakeholders involved in the project comprise of 3 layers, including the core team such as the SUT research team and staff directly involved with the project. SUT students and research assistants also benefit from ANSEE-Khao Yai, as practical problems are broken down to project-based learning tasks in which they can empathize, ideate, develop, design and test their prototype in the real world. They also learn from diverse local and research experts and develop a sense of awareness for conservation and responsible consumption.

The wider circle involved stakeholders including the national park administration and park rangers, the ANSEE-Khao Yai advisory board, SUT executives, local community and partnering organizations.

The widest circle included the regional park authorities, local authority, local enterprises, public relations media, relevant NGOs and various research funding agencies. Identifying and collaborating with these stakeholders have helped support the implementation and advocacy of ANSEE-Khao Yai Project.




## Renewable energy

Projects 1-2 involve the utilization of solar cells and green energy storages and mini electric vehicles for use in the park. Installed at the campgrounds, the renewable energy storage system provides power supply to park officers and camping visitors. This proved to be life-changing when power lines are cut due to frequent storms or fallen trees. The system consists of cutting-edge super capacity battery storage solutions providing extended battery lifetime integrated with off-grid solar powered energy solutions. An EV charging station was constructed for small electric vehicles resulting in significant cuts in fuel and electricity expenses and reduced GHG emissions. Approximately these systems provide clean energy of around 20 MWh yearly.

## Solar-powered pump

Apart from electric vehicles, the green energy system was customized for other applications.

Project 3 depicts the use of the battery solution for a water pumping system at a local farm. This helps reduce on-grid energy costs as well as promotes environment friendly farming.

The system has been replicated at Ched Sao Noi National Park and Phu Luang National Park by the project team to provide solar energy for park rangers and solar-powered water pumps supplying water sources for wildlife.

## EV route


As the transportation sector has been recognized to generate the largest share of greenhouse gas emissions, Project 4 takes the initiative of eco-friendly transportation.

This project proposed a sustainable transportation model using electric vehicles (EV) and optimize routes within the national park.



SUT in partnership with the Canadian Embassy in Thailand handed over an innovative garbage house facility to Khao Yai National Park in January 2022. The handover ceremony was presided by the Canadian Ambassador to Thailand. The innovation was one of the many innovations developed for the national park by a large multidisciplinary team of SUT researchers under the ANSEE-Khao Yai project to promote climate neutral sustainable ecotourism in the national park. Since then, there has been further collaboration with the embassy in partnership with SUT and Khao Yai National Park to create another nature trail for the national park to promote the livelihood of local communities and wildlife conservation.



# Environment

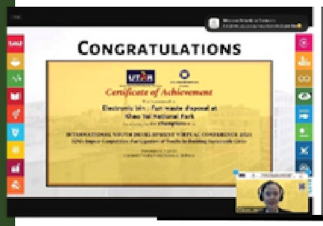

Project 5 focused on environmental problems and carbon footprint management. The team collected dataset from the park for an accurate Carbon footprint calculator, calculated the energy consumption in the park, and identified CO2 emission hotspots and distribution in the park. The carbon footprint calculator has also been used to maintain the carbon footprint of the park as a leading model for climate friendly parks in Thailand. The team also participated in the local events to promote carbon foot print awareness in the community.

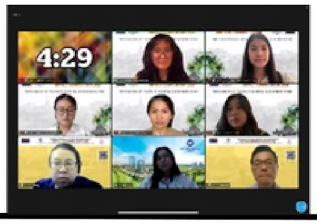
# Waste management

During the peak tourist season, limited staff and resources pose a serious waste management problem in the park. Waste disposals facilities quickly overfill. Wildlife can ingest the waste threatening their lives, their natural feeding behavior and thus, the overall world heritage status of the national park.

Project 6 developed two garbage disposal facilities in the park campgrounds, installed with voice activated and automatic sorting bins to facilitate visitors to dispose of their waste. The garbage facility has reduced trash littered outside the bins and increased recycled wastes.

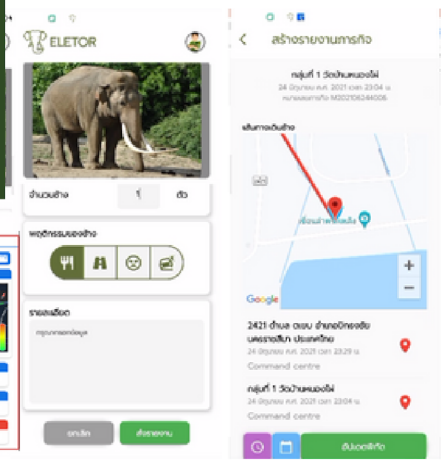
Twelve students worked on the project as part of the project-based course, winning an international award for the electronic bin design.



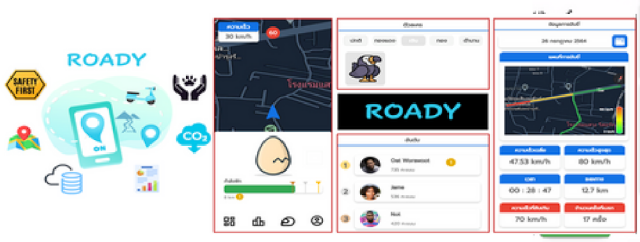


# Wildlife conflicts




Human-elephant conflicts are detrimental for the community near the national park and life threatening to wild elephants as well. Project 5 developed a digital platform called Eletor for tracking wild elephants in the park and the nearby community. With 26 rangers and civil volunteers trained, Eletor has been applied to monitor wild gaurs in the southern part of the park, Khao Phaeng Ma Non-hunting Area, where human gaur conflicts are severe.. Currently there are 45 national park rangers, across 7 operation teams, and 19 park rangers from Khao Phaeng Ma on the platform.

Speeding vehicles are a main cause of wildlife injury and fatality in the park. A mobile application called Roady was developed to promote safe driving as well as reduce GHG emissions.





Although technology-based solutions from all the previous projects play an important role in national park and community development, the success of the sustainable and environmental challenges lies in understanding and engagement with local community and stake holders.

Project 11 on project management and social impact assessment, is at the heart of ANSEE, coordinating and promoting understanding and awareness of the projects among researchers in the team and with local citizens, local businesses, local authorities, national park officers and administrators. The team also implemented student and community engagement strategies, project advocacy and scaled up the international, public and community impact of the project. The project also carries out a self assessment on the key elements that drive the research team, community and thus project to success.

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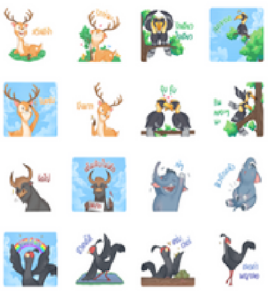
# Wildlife detection camera


Project 8 developed a detection camera and notification system for wildlife invasion and tracking natural resources in the park. The wildlife tracking sensing technology system has helped reduce manpower and enhance efficiency of the park's wildlife monitoring. Furthermore, the research team has won the 2023 National Invention Commendable Award for this innovation.


# Tourist behavior

Project 9 developed digital medias to educate park visitors and promote conservation awareness among the public and youth, by designing various forms of digital medias and incentives to promote ecotourism at the national park. Proceeds from the LINE application stickers sold has been donated to the National Park fund to aid park rangers.


# Local Upskill

Project 10 strengthened the community by training astrology and stargazing basics for local guides, students, park officers and their family in the community. With noise-free night skies, the park is amongst the best places for star gazing. The team held 4 workshops, training 110 locals and youth guides to promote sky gazing and basic astrology. With such upskill, locals were able to work as star guides for park visitors, thereby increasing their income and their quality of living.


ANSEE-Khao Yai project has been recognized as a leading "research to impact" model that can draw a large team of multi-disciplinary researchers to tackle real regional environmental challenges. The success and outcomes of the project and its organizational knowledge management and community engagement can be a useful model for other higher educations.