PRESS RELEASE

"BRUNEI'S PEAT SWAMPS ARE ONE OF A KIND AND HOLD
HIGH BIOMASS AND CARBON STOCK" – Expert finding from a collaboration
project under ASEAN FLAG and Forestry Department

Bandar Seri Begawan
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The Brunei Darussalam Conference on Biodiversity, themed "Biodiversity: Nature's Blueprint for Sustainability," continued on its second day with Plenary Session 2: "Research Opportunities in Brunei's Peatlands" held in the morning at the International Convention Centre, Berakas. The session featured three esteemed presenters from both local and international institutions.

Brunei Darussalam's peat swamp forests boast an extraordinary aboveground biomass" – Dr. Deepthi Chimalakonda (Arkadiah Technology Pte Ltd)

The Plenary Session 2 builds upon the groundbreaking findings unveiled on the first day of the conference, which were delivered virtually by the esteemed Gerry Ong, Honorary President and Climate Change & Sustainability Work Group Leader at the ASEAN Federation of Land Surveying and Geomatics (ASEAN FLAG), and Dr. Deepthi Chimalakonda, Head of Carbon and Biodiversity at Arkadiah Technology Pte Ltd. **Their findings unveiled that Brunei Darussalam's peat swamp forests boast an extraordinary aboveground biomass (AGB) ranging from approximately 470 to 560 tons per hectare, significantly surpassing the average AGB of 350 tons per hectare observed in other tropical rainforest countries in insular Asia. This disparity highlights that Brunei Darussalam's peat swamp forests are old growth forests and hold high biomass stocks.**

(Synopsis of the presentation attached)

"Brunei's peat swamps are some of the best-preserved in Southeast Asia" – Dr Rahayu Sukri (Institute for Biodiversity and Environmental Research (IBER),UBD

The first presentation of the Plenary Session 2, titled "Exploring the Biodiversity and Ecology of the Badas Peat Swamps," was delivered by Associate Professor Dr. Rahayu Sukmaria Haji Sukri from the Institute for Biodiversity and Environmental Research (IBER), Universiti Brunei Darussalam. She shared some amazing discoveries about Brunei Darussalam's unique peat swamps. Covering a whopping 16% of the country, **these swamps are some of the best-preserved in Southeast Asia. The Badas peat dome, connected to Sarawak's Baram basin, is a haven for diverse wildlife, yet largely unexplored. Unfortunately, the Shorea albida forests are in danger due to drainage and forest canopy issues, leading to more frequent fires.** With new technology, we're also learning more about nutrient cycles and carbon storage. And successful reforestation efforts, especially with Shorea albida, show that we can make a difference. These findings remind us of the importance of preserving Brunei's natural wonders for future generations.

(Synopsis of the presentation attached)

"Peatlands, storing double the carbon of forests and a critical carbon reservoir" Dr Alex Cobb (Singapore-MIT Alliance for Research and Technology)

The second presentation, titled "Carbon Sequestration in Peatlands as Ecosystem Service," was delivered by Dr. Alex Cobb, Senior Principal Scientist at the Singapore-MIT Alliance for Research and Technology (SMART). Ecosystem services from these habitats, including carbon sequestration, were emphasized, highlighting their significant contribution to mitigating climate change. **Peatlands, storing double the carbon of forests, represent a critical carbon reservoir, with potential emissions threatening global climate goals. The alarming emission rates from drained peatlands underscored the urgency of preserving their waterlogged state to prevent decomposition and fires.** Insightful observations revealed the detrimental impact of drainage, reducing the peatland's carbon storage capacity. However, the potential for satellite data to predict carbon dynamics offers a ray of hope for effective conservation strategies. Rewetting emerged as a crucial measure to mitigate fire risk, flooding, and carbon emissions.

These findings underscore the imperative of safeguarding peatlands, not only for their carbon stocks but also for their invaluable ecosystem services.

(Synopsis of the presentation attached)

"A preliminary estimate of Brunei's Peat Swamp Forests reveals a total of 3,264 tonne Carbon per hectare belowground Carbon Stock" – Dr Borhan Mohd (Lunima Sdn Bhd)

The third presentation, titled "The Peat Swamp Forest of Brunei Darussalam: Some Preliminary Findings from the National Forest Resources Inventory 2023-25 and Opportunities for Research," was delivered by Dr. Borhan Mohd, Project Manager at Lunima Sdn Bhd. Collaborating with the Forestry Department, their ongoing project, initiated in May 2023, aims to comprehensively evaluate and document the nation's forest resources. **Dr. Mohd's presentation offered a glimpse into their initial findings, with a focus on the belowground carbon stock of Peat Swamp Forests, revealing a preliminary estimate of 3,264tC/ha.** He also underscored the significance of fostering further research collaborations to enrich this critical study on Brunei Darussalam's forest resources.

(Synopsis of the presentation attached)

"Brunei is a Legend in Peat Swamp Forest" – Mr. Gerry Ong (ASEAN FLAG)

Conclusion: Findings from all three panelists highlighted that the substantial carbon storage capacity of peatlands is essential in climate change mitigation. Crucially, insights into peatland dynamics, including the detrimental effects of drainage on carbon storage and the vital role of rewetting in preservation, offer actionable strategies for environmental protection. Proactive measures to safeguard peatland carbon stocks and ecosystem services can be achieved by leveraging on satellite data. As we confront the challenges of climate change, the preservation of peat swamp forests emerges as a cornerstone in our collective efforts toward sustainability and environmental resilience. The panelists also urged the audience to explore the frontier of peatland research especially at Badas, where exciting opportunities await in our mission to protect our planet's carbon reservoirs.

In attendance to witness these presentations was Yang Mulia Dayang Noralinda binti Haji Ibrahim, Acting Deputy Permanent Secretary I at the Ministry of Primary Resources and Tourism. The second day of the conference was also attended by invited speakers from both local and international institutions, conference participants including local and international experts and

academics, government agencies, relevant private sector entities, non-governmental organizations, researchers, and students.

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Prepared by:
Forestry Department
Ministry of Primary Resources and Tourism
Brunei Darusslaam

Keynote Presentation 2:
Harnessing Tech for Brunei's Peatland Preservation

Mr Gerry Ong (Virtual) & Dr Deepthi Chimalakonda (Virtual)
11 June 2024 - Brunei Darussalam Conference on Biodiversity

At the recent Brunei Darussalam Conference on Biodiversity, the keynote presented on the groundbreaking advancements in estimating carbon and biomass stocks using a combination of manual measurements and advanced technology known as LiDAR. The overview of the project includes the technology integration whereby Arkadiah utilized its innovative technology to estimate carbon and biomass stocks by combining manual measurement with terrestrial laser scanning (TLS) for validation. The project focused on Two plots were mapped via terrestrial laser scanning (TLS) which includes half-hectare plot at Badas Peat Swamp Forest and a quart-hectare plot at Kargu Dipterocarp Plantation. The utilization of TLS allows for geo-tagging trees, creating a traceable and accountable system to monitor biomass stocks, thus minimizing errors common in manual measurements. The biomass stock data from sample plots were then extrapolated to larger areas.

Ways of measurement:
Manual mapping:
Manually measure the diameter, breast and height of the trees within the area plot.

LiDAR mapping:
Provides elevation view, data visualisation, measurement of plotted trees as well as the identification of each individual trees

Findings:
Arkadiah ran pantropical to locally specific allometric equations and combined with LiDAR results and collated and compared with AGB estimations for both LiDAR and manual measurements to see if there are big disparities. TLS and manual are congruent and consistent, resulting in similar numbers (470 - 560 ton/ha). **Other tropical rainforest countries in Asia (insular) have an average range of 350 ton/ha while in Brunei 470 - 560 ton/ha. This shows that Brunei's peat swamp forests are old growth forests and hold high biomass stocks**.

There is a tendency to underestimate biomass stocks and carbon stocks using GEDI NASA data. Hence, Arkadiah technology uses a hybrid model which integrates Remote Sensing data (Gedi) and ground truth data or LiDAR data. This will significantly improve the estimation of biomass stocks and carbon stocks by correcting the underestimated data by 75.9%. The findings showed that the hybrid model approach by Arkadiah provided a robust, rational and precise project level carbon estimation.

Conclusions and recommendations:
Brunei's peat swamps are one of a kind and hold high biomass and carbon stock. Detailed NFI (National Forestry Inventory) is needed to facilitate development of country-level and ecosystem specific allometric equations for comparisons

Plenary Session 2: Research Opportunities in Brunei's Peatlands
Exploring the Biodiversity and Ecology of the Badas Peat Swamps
(Speaker 1)

Associate Professor Dr. Rahayu Sukmaria Haji Sukri
Curator of Botanical Research Centre, Institute for Biodiversity and Environmental Research
(IBER), Universiti Brunei Darussalam
12 June 2024 - Brunei Darussalam Conference on Biodiversity

Dr. Rahayu offered an insightful overview of Brunei's forests, with particular emphasis on peat swamp forests, highlighting their unique characteristics and ecological significance. One notable feature discussed was the pink coloration resulting from acidic soil conditions, underscoring the delicate balance of these ecosystems. The discussion delved into the importance of conservation efforts focused on peat swamp forests, recognizing them as critical habitats for various species and essential contributors to environmental stability.

The presentation further explored the Badas Peat Dome, identified as the largest peatland in Brunei, characterised by its domed structure due to waterlogged conditions inhibiting proper decomposition of plant matter. Notably, research conducted in this area revealed its significance as a habitat for the Shorea Albida, a Borneo endemic species listed as Vulnerable under the IUCN Red List. Additionally, the presentation touched upon the scarcity of Kerangas, or sandy swamp forests, which constitute less than 1% of the landscape, often found in specific areas of the peat dome, contributing to the overall biodiversity of the region.

Dr. Rahayu has participated in various projects, such as the exploration of innovative methods for monitoring carbon stock and flux in Southeast Asia using spaceborne SAR and LiDAR observation. Her team conducted studies involving tree sample sensors and peat coring to analyse the composition and mineral content of peat swamp forests.

The reforestation initiative in the degraded Kerapah forest at Lumut, ongoing since 2015 and involving several partners, initially aimed to serve as a firebreak area but proved ineffective due to the peat nature of the land. In 12 plots, 240 saplings of native species commonly found in Brunei's peat swamp were planted to assess their suitability for forest restoration in degraded areas.

Although current results are pending, last year's findings indicated promising performance from Dryobalanops rappa, with a consistent 70% survival rate. However, it was advised against using the species Shorea rubrea, as it eventually perished. As of now, after 8 to 9 years, our tallest sapling (Dryobalanops rappa) grew up to 25 cm.

In conclusion, Dr. Rahayu's research underscores the urgent need for conservation efforts in Brunei's peat swamp forests, with a particular focus on the Badas Peat Dome. Through her

collaborative projects and extensive field studies, important insights have been gleaned regarding the composition and significance of these ecosystems. Dr. Rahayu's call for continued collaborations and further studies from fellow researchers highlights the collective responsibility to protect and preserve the biodiversity of the Badas Peat Swamp and similar habitats. Such endeavours are crucial for ensuring the long-term sustainability and resilience of these invaluable natural landscapes.

Summary:

Dr. Rahayu provided a comprehensive overview of Brunei's forests, with a special emphasis on peat swamp ecosystems, highlighting their distinct characteristics and ecological importance. She discussed the unique pink coloration resulting from acidic soil conditions, emphasising the fragility of these habitats and the necessity for conservation efforts. The presentation delved into the significance of peat swamp forests as critical habitats for various species and essential contributors to environmental stability. Dr. Rahayu also explored the Badas Peat Dome, the largest peatland in Brunei, and its role as a habitat for the vulnerable Shorea Albida species. Additionally, she discussed ongoing projects, including innovative methods for monitoring carbon stock and flux, as well as a reforestation initiative in the degraded Kerapah forest. Despite challenges, her research underscores the importance of collaborative efforts and further studies to protect and preserve the biodiversity of peat swamp ecosystems, crucial for their long-term sustainability and resilience.

Plenary Session 2: Research Opportunities in Brunei's Peatlands
Carbon Sequestration in Peatlands as Ecosystem Service
(Speaker 2)

Dr. Alex Cobb
Senior Principal Scientist, Singapore-MIT Alliance for Research and Technology
12 June 2024 - Brunei Darussalam Conference on Biodiversity

Dr. Alex commenced by expressing gratitude to the collaborators involved in his projects, acknowledging their contributions. He then proceeded to delve into the concept of carbon sequestration as an ecosystem service, emphasising its significance in mitigating climate change. Following this, he provided an overview of ecosystem services, honing in on peatlands and highlighting their pivotal role in carbon storage and other ecosystem functions. Moreover, he elucidated the process of valuing carbon sequestration, shedding light on the economic assessment of the carbon stored within peatlands and its implications for climate change mitigation strategies.

Continuing his presentation, the speaker offered an in-depth explanation of how peatland carbon sequestration operates, elucidating the mechanisms by which peatlands accumulate and retain carbon over time. He underscored the importance of preserving these ecosystems to maintain their carbon sequestration potential and prevent carbon dioxide emissions. Additionally, he outlined strategies for avoiding CO_2 emissions from peatlands, emphasising the need for sustainable land management practices, restoration efforts, and fire prevention measures. Through his comprehensive discussion, the speaker aimed to foster understanding of the intricate relationship between peatlands, carbon sequestration, and climate change mitigation, highlighting the urgency of conservation efforts in these critical ecosystems.

Dr. Alex further explained on the peatland carbon sequestration where it operates through a unique process influenced by the growth and structure of bogs. These bogs develop into mounded shapes, with peat rising to heights that allow for waterlogging. However, when peat rises too high, it loses its ability to remain waterlogged and begins to decompose. This natural mechanism regulates the height and shape of bogs, ensuring that peat remains in a state conducive to carbon preservation. Importantly, peat can only be protected from decomposition and subsequent release of carbon dioxide when it remains waterlogged. Therefore, the preservation of peatlands relies on maintaining the waterlogged conditions necessary to sustain carbon sequestration over time.

Dr. Alex's presentation on carbon sequestration as an ecosystem service concluded with a thorough exploration of the processes and importance of peatland carbon sequestration. He began by expressing gratitude to his collaborators and then proceeded to highlight the significance of carbon sequestration in mitigating climate change. With a focus on peatlands, he underscored their critical role in carbon storage and other ecosystem functions, emphasising the need for their preservation. Furthermore, he elaborated on the economic assessment of carbon sequestration and outlined

strategies for avoiding CO2 emissions from peatlands through sustainable land management practices and restoration efforts. Through his detailed discussion, Dr. Alex aimed to raise awareness of the intricate relationship between peatlands, carbon sequestration, and climate change mitigation, stressing the urgency of conservation efforts in these vital ecosystems. He concluded by emphasising the importance of understanding how peatlands store carbon to protect their carbon stock and other ecosystem services effectively.

Summary:

Dr. Alex began his presentation by expressing gratitude to his collaborators and then delved into the concept of carbon sequestration, emphasising its role in mitigating climate change. He provided an overview of ecosystem services, focusing on peatlands and their pivotal role in carbon storage. Dr. Alex explained the process of valuing carbon sequestration and outlined strategies to prevent CO2 emissions from peatlands, stressing the importance of preservation and sustainable management practices. He elaborated on the unique process of peatland carbon sequestration, emphasising the need to maintain waterlogged conditions to protect carbon. Through his comprehensive discussion, Dr. Alex aimed to raise awareness of the critical role of peatlands in carbon sequestration and underscored the urgency of conservation efforts in these ecosystems.

Plenary Session 2: Research Opportunities in Brunei's Peatlands

The Peat Swamp Forest of Brunei Darussalam: Some Preliminary Findings from the National Forest Resources Inventory 2023-25 and Opportunities for Research (Speaker 3)

Dr. Borhan Mohd
Project Manager, Lunima Sdn Bhd
12 June 2024 - Brunei Darussalam Conference on Biodiversity

Dr. Borhan presented an overview of the National Forest Resources Inventory 2023 - 25, aimed at conducting a comprehensive survey of the country's forests to establish a national inventory. A significant focus is placed on assessing carbon stocks within peat swamp forests concerning their impact on global warming and potential for carbon trading. The primary objectives encompass gathering baseline data on forest carbon stocks, aligning the NFRI with Forestry Department standards and international best management practices, and updating relevant data and maps to facilitate sustainable forest management across Brunei's diverse forest types, including the Belait Peat Swamp Forest, Mangrove Forest, Mixed Dipterocarp Forest, Heath Forest, Freshwater Swamp Forest, Montane Forest, and Secondary Forest.

The objective of the forest inventory is to establish an inventory encompassing both carbon and non-carbon stocks, such as the woody/cellulosic component within the studied forest, which involves sampling, measuring, and estimating Aboveground Biomass (ABG) and Belowground Biomass (BGB). Dr. Borhan provided insights into the peat soil carbon inventory, which involves assessing the carbon stock alongside its physical and chemical properties. The study focused on the Badas Peat Swamp Forest, employing manual probing with a custom-made instrument. Sample plots were arranged in clusters of nine probing points spaced at 5m intervals, with each plot situated 200m apart along sampling lines. The findings revealed that Brunei's peat soil contains an average carbon stock ranging from 21,424.98 to 35,308.04 cubic metres per hectare. Additionally, Dr. Borhan discussed a project concerning peat depth mapping aimed at establishing a national baseline data on carbon stock, indicating that the volume of peat in the Badas region ranged from 35,708.3 to 58,833.4 cubic metres per hectare.

In the coming weeks and months, the activities within this component of the NFRI Project will involve the continuation of probing exercises on peat soil and the collection of additional data from various peat swamp forest (PSF) areas nationwide until a sufficient amount of information has been gathered to significantly advance the NFRI's objectives. Following data collection, the results will be presented to the Forestry Department (FD), and seminars will be conducted to disseminate findings and insights, fostering collaboration with other agencies and organizations to enhance the project's scope and impact. Employing cutting-edge technologies like drones and LiDAR, the aim

is to conduct aerial surveys to complement ground-level data collection efforts, ensuring a comprehensive understanding of forest resources. Additionally, training sessions will be facilitated for relevant FD staff, empowering them with the necessary skills and knowledge to support ongoing and future initiatives effectively. Lastly, comprehensive reports will be produced on the findings and activities, contributing to the body of knowledge in forest resource management and conservation.

Dr. Borhan's presentation shed light on the ambitious National Forest Resources Inventory 2023 - 25, which seeks to conduct a thorough examination of Brunei's forests to establish a comprehensive national inventory. With a keen focus on evaluating carbon stocks within peat swamp forests and their implications for global warming and carbon trading, the project aims to gather crucial baseline data, align with Forestry Department standards, and update relevant information for sustainable forest management. Dr. Borhan's insights into peat soil carbon inventory, particularly in the Badas Peat Swamp Forest, revealed valuable findings regarding carbon stock and peat volume, providing essential knowledge for future conservation efforts. Moving forward, the NFRI Project will continue its probing exercises and data collection, collaborate with relevant stakeholders, leverage advanced technologies for aerial surveys, conduct training sessions, and produce comprehensive reports to advance forest resource management and conservation practices in Brunei.

Summary:
Dr. Borhan outlined the National Forest Resources Inventory 2023 - 25, aimed at conducting a comprehensive survey of Brunei's forests to establish a national inventory with a focus on assessing carbon stocks within peat swamp forests. The objectives include gathering baseline data, aligning with Forestry Department standards, and updating relevant information for sustainable forest management. Insights into peat soil carbon inventory, particularly in the Badas Peat Swamp Forest, revealed valuable findings regarding carbon stock and peat volume. Moving forward, the NFRI Project will continue probing exercises, collaborate with stakeholders, employ advanced technologies for aerial surveys, conduct training sessions, and produce comprehensive reports to advance forest resource management and conservation practices in Brunei.