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Green and carbon neutral campus policy

A university or other educational institution may establish a number of rules and programs to lessen its negative effects on the environment and cut carbon emissions. These programs and rules are referred to as green and carbon-neutral campus policies. By fostering energy efficiency, renewable energy sources, trash reduction, and other sustainable behaviours, these policies seek to promote a sustainable campus environment. The following are some significant elements and actions often included in green and carbon-neutral campus policies:

1. **Renewable Energy**: Campuses strive to produce a significant amount of their energy from renewable resources like solar, wind, or geothermal energy. They could put up windmills, solar panels, or make investments in regional renewable energy initiatives.
2. **Energy Efficiency**: It is essential to use energy-efficient technology and procedures. Campuses may carry out energy audits, replace inefficient lighting with LEDs, construct effective HVAC (Heating, ventilation, and air conditioning) systems, and teach staff and students about energy efficiency.
3. **Promoting environmentally friendly** transportation choices lowers carbon emissions. Campuses may encourage students to utilize bicycles, footbridges, and public transportation. They can also install electric car charging stations and run bike-sharing programs.
4. **Waste Management**: A green campus strategy should include the implementation of recycling programs, composting, and a reduction in waste creation. Common measures include providing recycling bins, running awareness campaigns, and reducing the usage of single-use plastics.
5. **Green Building Standards**: Buildings that are built or retrofitted in accordance with green building standards, like LEED (Leadership in Energy and Environmental Design), may dramatically cut their energy use and encourage the use of sustainable building materials.
6. **Water Conservation**: Campuses may design water-efficient landscaping, put in low-flow fixtures, and run educational initiatives to spread knowledge of wise water use.
7. **Sustainable buying**: Choosing environmentally friendly goods and services first is a key component of sustainable buying methods. This might include buying products made locally, selecting energy-efficient equipment, and choosing eco-friendly cleaning products.
8. **Environmental Education and Awareness**: It's crucial to encourage environmental education and raise awareness among academics, staff, and students. This may be accomplished through

include sustainability in the curriculum, setting up seminars, and sponsoring sustainability-related activities.

9. **Carbon Offsetting**: Some campuses may decide to participate in carbon offset projects like reforestation or renewable energy initiatives in order to offset their leftover carbon footprints.

10. **Collaboration and Partnerships**: Campuses may access resources, financing, and knowledge through partnering with local companies, non-profits, and governmental entities to fulfil their sustainable objectives.

11. **Monitoring and Reporting:** Establishing systems to track energy consumption, greenhouse gas emissions, and other sustainability metrics enables the campus to measure progress, identify areas for improvement, and report on its environmental performance.

Educational institutions may set a positive example for future generations and encourage them to prioritize sustainability by implementing a green and carbon-neutral campus policy. This will also help them to lessen their environmental impact and support global climate action.

Reforestation in college campuses in Kerala

Reforestation in college campuses in Kerala, India, can play a vital role in promoting environmental conservation, biodiversity, and creating sustainable learning environments. Here are some steps that colleges in Kerala can take to implement reforestation initiatives on their campuses:

1. **Campus Assessment**: Begin by conducting an assessment of the college campus to identify suitable areas for reforestation. Consider factors such as available land, soil conditions, sunlight exposure, and existing vegetation.

2. **Tree Selection**: Identify native tree species that are well-suited to the local climate and ecosystem. Native trees have adapted to the region's conditions and are more likely to thrive, support local biodiversity, and preserve the natural heritage.

3. **Land Preparation**: Prepare the identified areas for reforestation by clearing invasive species, weeds, or debris. Ensure that the soil is adequately prepared and suitable for tree planting.

4. **Tree Planting:** Organize tree planting drives involving students, faculty, and staff members. Provide guidance on proper planting techniques, including digging appropriate-sized holes, watering, and mulching. Encourage active participation and awareness about the importance of reforestation.

5. **Maintenance and Care**: Implement a maintenance plan to ensure the survival and growth of the newly planted trees. This includes regular watering, mulching to retain moisture, protection from grazing animals, and periodic pruning or trimming.

6. **Biodiversity Enhancement**: Reforestation efforts can go beyond just planting trees. Consider incorporating native shrubs, flowering plants, and creating habitats such as butterfly gardens or bird feeders to attract and support local wildlife.

7. **Educational Programs**: Utilize the reforested areas as outdoor classrooms and living laboratories. Organize educational programs, nature walks, and workshops to raise awareness about the importance of forests, biodiversity, and climate change.

8. **Collaboration**: Seek partnerships with local environmental organizations, government agencies, and NGOs working in the field of reforestation and conservation. Collaborative efforts can enhance knowledge sharing, resource mobilization, and overall impact.

9. **Monitoring and Evaluation**: Regularly monitor the progress of the reforestation project by assessing tree survival rates, growth, and overall ecosystem health. This information can guide future efforts and help refine reforestation strategies.

10. **Long-term Sustainability**: Develop a long-term plan for the maintenance and sustainability of the reforested areas. Engage the college community, including alumni and students, in taking ownership of the project and ensuring its continuity.

Reforestation initiatives in college campuses in Kerala can contribute to combating climate change, preserving biodiversity, and fostering a sense of environmental stewardship among students and the wider community.

High carbon sequestration Plants

Several plants are known for their ability to absorb and store significant amounts of carbon dioxide (CO_2) from the atmosphere through the process of photosynthesis. Here are some examples of high carbon dioxide absorbing plants:

Bamboo (Bambusoideae): Bamboo is a fast-growing plant that can absorb a substantial amount of CO_2 and release a large amount of oxygen. It is highly efficient in carbon sequestration due to its rapid growth and dense biomass.

Tropical Rainforest Trees: Tropical rainforest trees, such as the Amazon Rainforest species like Brazil nut trees, Kapok trees, and Ceiba trees, have large canopies and extensive root systems that enable them to absorb significant amounts of CO_2.

Ferns: Ferns are known for their high photosynthetic rates and ability to capture and store carbon. They have a dense leaf structure and are effective in sequestering CO_2 from the atmosphere.

Mangrove Trees: Mangrove trees are highly efficient in carbon sequestration. They thrive in coastal regions and estuaries, and their dense root systems store large amounts of carbon.
Seagrass: Seagrasses are aquatic plants found in coastal regions. They are highly effective in absorbing and storing carbon dioxide, making them valuable carbon sinks.

Cacti and Succulents: Cacti and succulent plants have specialized adaptations to conserve water, such as their ability to store water in their leaves and stems. These plants can efficiently absorb and store CO_2 while minimizing water loss.

Broadleaf Trees: Various broadleaf tree species, such as oak, maple, and beech, are known for their carbon sequestration capabilities. They have large canopies and extensive root systems that contribute to efficient CO_2 absorption.

Algae: Algae, including both macroalgae (seaweeds) and microalgae, are highly efficient in absorbing and storing carbon dioxide. They play a significant role in marine ecosystems as well as in artificial algae-based carbon capture and storage systems.

Peatlands: Peatlands, such as bogs and marshes, are important carbon sinks. The waterlogged conditions and accumulation of organic matter in peatlands allow them to absorb and store large amounts of CO_2.

Coniferous Trees: Coniferous trees, such as pine, spruce, and fir, are known for their efficient carbon absorption. They have needle-like leaves that allow them to retain moisture and continue photosynthesis even in cold or dry conditions.

Remember that the overall carbon sequestration capacity of a plant depends on factors such as its size, growth rate, and environmental conditions. Creating diverse ecosystems with a mix of different plant species is essential for maximizing carbon absorption and creating sustainable environments.

Kerala, located in the southern part of India, is blessed with diverse ecosystems and a rich variety of tree species. While all trees play a crucial role in absorbing carbon dioxide and reducing greenhouse gas emissions, some tree species in Kerala are particularly known for their low carbon emissions and high carbon sequestration capabilities. Here are a few examples:

Teak (Tectona grandis): Teak is a tropical hardwood tree that is native to Kerala. It is highly valued for its durability and has a high carbon sequestration capacity, making it an excellent choice for reforestation projects.

Indian Rosewood (Dalbergia latifolia): Also known as Sheesham or Irumbavu, Indian Rosewood is a large deciduous tree found in Kerala. It has a dense and durable wood, and its long life span contributes to significant carbon storage.

Indian Elm (Holoptelea integrifolia): Indian Elm, commonly called Kanjiram, is a medium-sized deciduous tree native to Kerala. It is known for its ability to withstand harsh environmental conditions and has been planted extensively for urban greening and carbon sequestration.

Indian Laurel (Terminalia elliptica): Indian Laurel, known as Malayalam: Karimaruthu, is a large evergreen tree found in Kerala's forests. It has dense foliage and can sequester substantial amounts of carbon throughout its lifespan.

Indian Cork Tree (Millingtonia hortensis): Indian Cork Tree, also known as Akash Neem, is a medium-sized deciduous tree native to Kerala. It has a rapid growth rate and provides significant carbon sequestration benefits.

Indian Kino Tree (Pterocarpus marsupium): Indian Kino Tree, locally known as Malayalam: Venga, is a medium-sized deciduous tree found in Kerala's forests. It is known for its high carbon sequestration capacity and the production of valuable gum resin.

Indian Mahogany (Swietenia mahagoni): Indian Mahogany, also known as Malayalam: Aini, is a large deciduous tree found in Kerala. It is valued for its durable wood and is recognized for its potential to sequester carbon effectively.

Jackfruit Tree (Artocarpus heterophyllus): Jackfruit Tree, called Chakka in Malayalam, is a large evergreen tree native to Kerala. While it is primarily known for its fruit, its extensive leaf canopy contributes to carbon sequestration.

A case studies by DAUD et al.

It's important to note that every tree species plays a role in reducing carbon emissions, and maintaining a diverse mix of trees is beneficial for overall ecosystem health and resilience

The ability to absorb carbon dioxide was compared in the studies by DAUD et al. (2019). Table 2 shows the mass of carbohydrates in leaf samples from seven different plant species that were taken at 6:00 a.m. and 11:00 a.m., the difference between these carbohydrate masses, and the mass of absorbed carbon dioxide that was computed using these data. S. mmahagoni had the largest carbohydrate mass in leaf samples taken at 6:00 a.m., 5.460 g, while P. indicatus had the lowest, 0.260 g (Table 2). S. mahagoni had the greatest carbohydrate mass in the samples taken at 11 a.m. (6.420 g), while B. asiatica had the lowest (2.720 g). S. mahagoni did not have the maximum carbon dioxide absorption per leaf or per tree, despite having the largest carbohydrate mass at both sampling periods (at 6:00 a.m. and 11 a.m.). This may be due to the fact that not all results of photosynthesis are stored as carbs, since some are required again for respiration and other metabolic activities. variable plant species have variable carbohydrate mass. From 6 to 11 a.m., all of the plants under investigation increased their carbohydrate mass. Due to insufficient sunlight intensity reaching the plants at 6 a.m., there is no photosynthesis. Photosynthesis cannot take place if one of the necessary conditions (sunshine) is not present. The intensity of sunlight during sampling at 6 a.m. varied from 130 lux to 370 lux. According to Taiz and Zeiger (2003), the purpose of light is to activate certain chlorophyll molecules located at the reaction center. Due to the beginning of photosynthesis and the increased intensity of sunlight around 11 a.m., there are more carbohydrates present.

There were differences in the carbohydrate mass across the seven species under investigation, suggesting that each kind of plant has a unique capacity to manufacture carbs. The T. catappa plant absorbed the most CO_2 for photosynthesis, amounting to 2.050 g, during the five hours (6 am–11 am) when the plant's greatest carbohydrate content was 1,390 g. The least amount of CO_2 was absorbed by C. inophyllum, which was 0.220 g. The formation of carbohydrates increases with the amount of CO_2 absorbed by plants. This is in line with claims made by Purwaningsih (2007) and Lailati (2013), according to which the quantity of carbon dioxide absorbed is exactly equal to the mass of carbohydrates because, during photosynthesis, the amount of carbon that is bound in sugar determines how much carbon dioxide is absorbed.

Table 5. Carbon dioxide absorption per tree per hour, and per year

Species	**Carbon dioxide absorbtion per tree per hour (g/tree/hour)**	**Carbon dioxide absorbtion per tree per year (kg/tree/hour)**
Barringtonia asiatica (L.) Kurz	162.640	584,137.054
Calophyllum inophyllum L.	146.173	524,994.749
Filicium depiciens (Wight & Arn.) Thwaites	241.084	865,878.767
Mimusops elengi L.	878.516	3,155278.425
Pterocarpus indicus Willd	4624.293	1,660,8610.879
Swietenia mahagoni (L.) Jacq.	403.409	1,448,884.339
Terminalia catappa L.	1792.653	6,438,494.301

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