

Table 1. Comparison of land used in photovoltaic (PV) power plants worldwide⁴

PV plant location	Power (MWp)	Site area (ha)	ha/MW	Year	Remarks
Perovo, Ukraine	100+	200	2.0	2011	c-Si PV modules; site has growth potential
Sarnia, Ontario, Canada	92	94	1.02	2010	Cd Te thin film PV modules
Finsterwelde, Germany	83	95	1.1	2010	c-Si PV modules
Montalto di Castro, Italy	72	80	1.1	2010	c-Si PV, tracking panels
Boulder City, USA	55	140	2.5	2010	CdTe PV, Nevada desert
Pocking, Germany	10	7.5	1.3	2006	Site area 32 ha includes sheep farm
Kolar, Karnataka, India ⁵	3.0	4.2	1.4	2010	c-Si modules

between 208 and 275 GWe by the year 2050 (ref. 3), assuming availability of reactors and fuel from international sources and indigenous development as planned presently.

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Biodiversity regain in abandoned tea plantations

India is the largest tea-producing country in the world and contributes 33% of the global tea production¹. Much of this tea comes from the biodiversity hotspots in the northeastern regions and the Western Ghats. Due to market fluctuations, increasing costs of production and lease expiry, many coffee, tea and cardamom plantations have become unviable for active management, resulting in labour unrest². In Thiruvananthapuram division of Kerala alone, 536 ha (55%) of the total 969 ha of the planted area was abandoned³. This has important consequences for biodiversity conservation and livelihoods.

The rather sudden and potential release of land due to plantation abandonment after decades or centuries of use has understandably led to a serious debate among the State Forest Departments and conservationists on the policies for future land use in plantations. When plantations are abandoned they are biodiversity-poor, susceptible to invasion by exotic species and economically not useful. But given the location of the plantations, they have a high potential for harbouring and facilitating biodiversity

to exist in the landscape. Conservation schemes in and near large tea plantations face unique livelihood challenges that arise from the fact that plantation workers have become accustomed to mountain environments that provide conducive climatic conditions to pursue assured livelihoods.

We conducted field visits to several tea plantations in southern Kerala, such as Rosemala, Kallar in the Shendurni Wildlife Sanctuary, Bonacaud on the fringes of the Peppara Wildlife Sanctuary and Ponnudi and Kalakad Mundanthurai Tiger Reserve in Tamil Nadu. Tea habitats per se are poor in biodiversity unlike coffee and cardamom, which have native or exotic species tree cover, but tea plantations do facilitate movement of wildlife^{4,5}. Abandoned plantations offer excellent opportunities to restore various forms of native biodiversity, but considerable effort from the landowners and the forest department is needed to restore the land to harbour native flora and fauna. Our recent study⁶ has shown that this can be done. Tea plantations with planted shade trees are important for native species to colonize through frugivore

activity⁶. When this is combined with active dispersal of seeds based on the life-history traits of the plant species, one can draw up a comprehensive protocol for restoration of native forests.

Conservation and livelihood challenges are formidable in geographies where plantations and Protected Areas (PAs) coincide. In the Thiruvananthapuram division, many plantation workers are struggling to find alternate livelihood sources after the plantations were abandoned. Many families are working as casual labourers in the road construction schemes, or in some cases like in Bonacadu, the workers themselves pluck the tea leaves and sell it to middlemen at low prices to sustain themselves. In Ponnudi, after the Ecologically Fragile Land Act (EFL) which restricts extensive modification of the land was enforced in 2003, many tea plantations could not sustain themselves (pers. obs.). In such cases where regulations like EFL exist, we suggest that plantation managers employ plantation workers and their families in restoration activities in parts of the plantations where such regulations are applicable. The wages for this can come from

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the National Rural Employment Guarantee Act. The remaining plantations can then function normally. The restored landscape can be opened up for ecotourism that could generate revenue to offset losses arising from biodiversity restoration. The issues arising out of plantation abandonment are complex and need to be studied in greater detail. There are no win-win situations, but a working compromise needs to be made where both workers' livelihoods and ecological stability of the landscapes are met.

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ACKNOWLEDGEMENT. This study was funded by the Royal Norwegian Embassy, New Delhi.

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A logical approach for worldwide carbon reduction

The proceedings of the Copenhagen meeting have saddened us. Adopting a political eye, each country wants to do the least and at the least cost. For this reason, conventions like the Kyoto Protocol and Copenhagen Accord do not have much of a future; they are only good as interim measures.

Carbon has been building up in the atmosphere. Presently, much emphasis is given on mitigation at 'source'. But a substantial amount of carbon still remains unabsorbed and enters the atmosphere, causing global warming. This is where 'sinks' come in. Our objective should be to maintain a balance between the worldwide sources and sinks of CO₂ so that further build-up stops. This has to be our first guiding principle to avoid global warming and prevent climate change¹.

Obviously, the world does not have enough sinks (forests, trees, oceans, freshwater bodies, wetlands) to take care of present-day emissions, as otherwise CO₂ build-up would not be occurring. I submit that there is an equally strong case for increasing sinks as there is for reducing sources. However, we must first protect existing sinks.

The first step is to stop deforestation. It is estimated that this would reduce CO₂ by ~20%. The REDD programme, instituted in 2008 by the UN for reducing emissions from deforestation and forest degradation in developing countries, evidently admits that we need both reduction in carbon emission sources and increase in sinks to absorb the carbon.

We need both equally and should therefore be willing to pay for both. In fact, we are already making payments, through carbon credits, to secure rights over newly developed dedicated forests. Now, we have to make payments under the REDD scheme for saving our existing forests.

Many more such transactions have to take place and the concept has to be formally incorporated into the carbon-

reduction strategy of every country (Figure 1). Ideally, in future, the world's countries could be told that each country can produce as much CO₂ as it can conveniently absorb through its own sinks as well as those available to it on lease basis from other countries.

The carbon absorption capacity of sinks in warmer regions is much higher than those in colder regions. A tree located in a cold or temperate climate

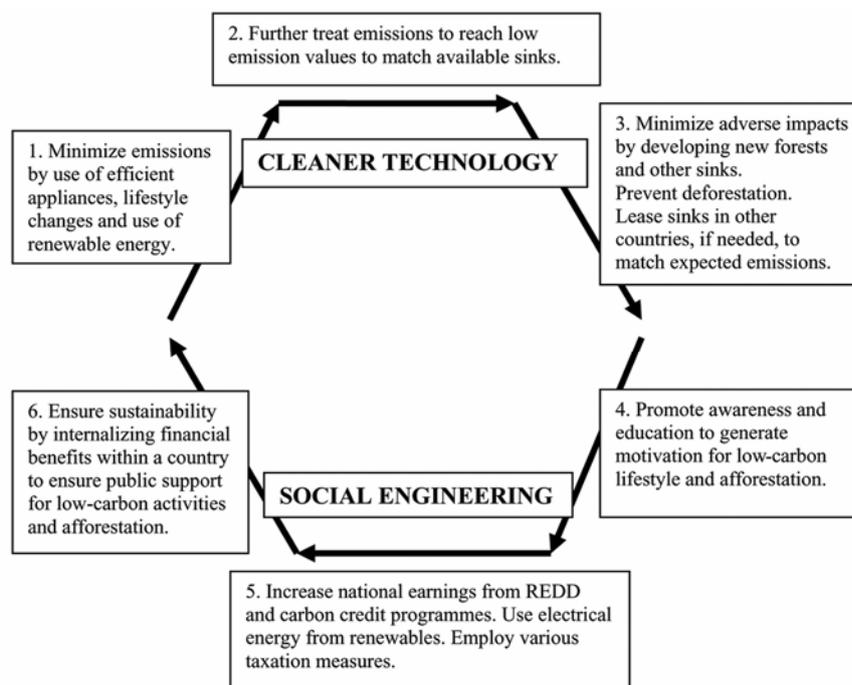


Figure 1. The carbon-neutral wheel.