

## Assessing the impact of reforestation and renewable energy on economic development in Costa Rica

In recent decades Costa Rica has been a pioneer for building an economy around concern for the environment and sustainability. According to a recently launched economic plan the country aims to decarbonize by 2050 (World Economic forum 2019). This is an ambitious, yet plausible, commitment to tackling climate change from a country that has fervently developed its reforestation programme and shown a healthy trend for renewable energy. The impacts of their aggressive policy are ubiquitous on both a governmental level and on a community and individual level; both pecuniary and non-pecuniary. I will assess which of these policies is a greater economic success for both government and individuals, as there are inevitably resource trade-offs between expanding the two programmes. For example the reforestation programme is partially funded by fossil fuel tax revenue. When looking at both policies in greater depth I will argue that increasing renewable energy use has so far been more effective than reforestation policy in the long-term economic development of Costa Rica.

### Reforestation

The 1990s saw a significant focus on environmental issues on the international agenda. PES's (Payment for Environmental Services) were adopted worldwide yet predominantly distributed on a local scale within individual countries. Costa Rica initiated a national system. In 1997 Costa Rica implemented a PES system where landowners could receive a payment for using their land for reforestation or forest conservation (Locatelli et al. 2008). A study by Bull et al. (2006) looks at reforestation subsidies more generally, concluding they may in fact be to the detriment of those forests targeted as the subsidies distort the market price for forest products in a downward trend. However in Costa Rica the effects are more complex than this. From a reforestation perspective there has been a success in that the deforestation trend of the country has stalled. Studies of the effectiveness of the country's payment programme, known as the PSA programme (*Pago por Servicios Ambientales*), have found recipients of the financing have greater forest cover than non-

recipients (Pagiola 2008) yet the benefits of the programme are not as abundant as this trend may appear.

In terms of the economic effects of the PES programme there is a division between smaller and larger landowners. The 1995 forestry law generated polarizing views (Le Coq et al. 2015), with the agricultural sector being traditionally against policy that conserved the forest land they required for economic development. The deforestation ban limited the economic growth of the agricultural sector. It is likely that smaller farmers would be more threatened by this. In terms of the PES programme the effects are more uncertain. Pagiola (2008) notes that the Fund for financing the reforestation programme changed its agenda in the lead up to his study through prioritising disadvantaged areas and poorer districts. On the other hand Zbinden and Lee (2005) find that recipients of the PSA are, on average, farmers with larger plots of land, but perhaps this is before the shift in emphasis that Pagiola was referring to. Locatelli et al. (2008) find that the socioeconomic impacts of the programme were clearly negative for small farmers and working class landowners whilst the impacts were positive for upper class landowners. According to Locatelli et al. (2008) the income effects of the programme are dependent on whether they are short-term or long-term. They find that the impact on short-term income was negative for smaller farmers and bigger landowners, whereas in the long-term the effect was very positive for upper-class landowners and very negative for smaller landowners. The long-term disparities in this findings shows that there is perhaps a regressive economic element to this programme with the poorer and smaller farmers experiencing a greater economic decline as a result. However in terms of socio-economic indirect beneficiaries the benefits are more evenly spread as factors such as increased employment are taken into consideration. Given the agricultural sector as a whole was largely against the forest conservation it is not a surprise to find that the smaller members of this community have suffered economically. The problem was that smaller farmers were too divided to mount significant collective resistance to the change.

From an economic perspective a PES programme has a number of inefficiencies as well as the identified iniquities (Pagiola 2008), some of which can be applied to Costa Rica's PSA. For example offering insufficient payment to induce the correct implementation of the programmes desired land uses. The result may be a continuation of the existing land use to

the detriment of the programmes intended outcomes. The programme may also attract those who were already considering adopting the reforestation policy. The structure of Costa Rica's PSA programme is allowing inefficiencies as it 'offers a relatively low, undifferentiated, and mostly un-targeted payment' (Pagiola 2008, pg.717). As a result of these characteristics it is unlikely socially-desirable land uses will be achieved on the scale desired, particularly due to the low payment. This low payment is particularly troublesome for smaller farmers, who do not have enough land to sacrifice to reforestation if the payment is low, instead it would make more economic sense for them to continue to farm as they do, and if they own forested areas to turn these into farmland. Higher funding may be required to prevent forest conversion, particularly in a country with numerous smaller farmers. When looking at the Osa Peninsula Sierra and Russman (2005) highlight the inefficiencies of the PES programme. Given the demand for PES outweighs its funding supply suggests a similar conclusion to Pagiola; many landowners would conserve their forests even if the PES value were to decrease. On average a landowner leaves 75% of land in the Osa Peninsula to forest cover, which is already a high figure. However up until the introduction of the PES in 1997 forest cover in the peninsula decline from 97% (1979) to 89% in 1997 (Sanchez-Azofeifa et al. 2002), suggesting there may have been some need for the programme. In spite of this the proclivity of farmers in the Osa Peninsula to abandon agricultural use of land suggests that in the long term a similar level of forest cover could be achieved without the programme. There is also the long term issue that the contracts do not cover gains in forest cover, meaning the opportunity cost to landowners of abandoning their land for reforestation increases over time. According to Sierra and Russman (2005) landowners regularly cut back their forests to maintain some pasture land and are encouraged by the nature of the programme to keep fallows to a minimal. This is an example of the programme's inefficiency, as it appears to be orientated to short-term use. There is the opportunity cost of a fall in agricultural production in the short-term whilst in the long-term the forest cover gained may regress back to agriculture. This inefficiency is in essence creating delayed production in exchange for short-term economic utility, and in the long-term is having little or no desired environmental effect of an increase in forest cover.

### Renewable energy

1996 was an important year for the growth of renewable energy in Costa Rica as the Government approved a law promoting renewable sources of energy (Nandwani 2006). In

terms of a crossover with the reforestation policy there is an obvious contention; the PSA programme is predominantly financed by fossil fuel tax revenue. According to Pagiola (2008) this was around \$10million a year at the time of his study. There is a consequently a trade-off in some capacity between both reforestation and renewable energy policy given the former is partially funded from tax revenue the latter hopes to reduce.

Looking at the country as a whole Al-Mulali et al. (2013) find there to be no long-run relationship between carbon dioxide emissions and economic growth in Costa Rica. A consequence of this would be an assumption that Costa Rica reducing its carbon dioxide emissions would likely have little effect on economic growth given there was no positive or negative relationship found. While this may be a result of an established shift to low/zero carbon dioxide emission energy consumption, the study from 1980-2008 also shows a long-run positive relationship in Costa Rica between emissions and energy consumption. So it may be the case that it would be more efficient for the country to increase its use of renewable energy as a proportion of overall energy and decrease its consumption of fossil fuels. Including Costa Rica in their study of Central America, Apergis and Payne (2011) find a long-run relationship between real GDP, consumption of renewable energy, the labour force and real gross fixed capital formation. From this they find that an increase in renewable energy use by 1% will increase real GDP by 0.244%. This echoes the conclusion that it would be economically prudent for Costa Rica to implement more renewable energy consumption. Of course it is necessary to highlight what the figure may be for a 1% increase in fossil fuel consumption and the effect this has on real GDP. However the real GDP benefit of an increase in renewable energy is not the only economic benefit from increased dependence on its production, as Apergis and Payne note. As they conclude expanding your domestic renewable energy industry makes you more autonomous in your energy consumption meaning you are less dependent on the volatility of foreign fossil fuel prices, as well as helping to negate any future environmental problems that might incur. Nevertheless volatility does crossover into renewables as some sources are dependent on climate factors. For example Costa Rica gets most of its renewable energy from hydroelectric power, which is heavily dependent on consistent rainfall (Fendt 2015), meaning a drought may require a reserve reliance on fossil fuels. In recent years Costa Rica's consumption of hydroelectric power as a percentage of energy use has remained dominant, so this effect has thus far had little overall impact year-

by-year despite some seasonal variations. As a result when comparing an increase in renewable energy with reforestation on a macro scale it seems more economically efficient to focus more on green energy.

Bildirici (2012) looks at a particular division of renewable energy through the relationship of biomass energy to economic growth. The benefits of biomass energy echo those discussed earlier by Apergis and Payne given it is something that can be produced anywhere. Including Costa Rica in the study, Bildirici finds that biomass energy is a stimulus to economic growth. Whilst also advocating that increased use of biomass energy can help abate poverty because it can satisfy demand at all times without expensive means of conversion. This can translate to many different forms of renewable energy. For example solar panels in a tropical country such as Costa Rica can help poorer communities be more self-sufficient in terms of energy consumption whilst also saving money in the long-term without dependence on fossil fuel consumption which is a regular cost for households. In terms of renewable energy Costa Rica, as mentioned earlier, is heavily reliant on hydroelectric power; Lindo (2006) quotes hydroelectric power to account for 80% of the nation's electricity provision. Hydroelectric power is a more contentious form of renewable energy despite being heavily suited to Costa Rica's heavy rainfall and mountainous terrain. According to Lindo (2006), on top of damage to the local ecosystem hydroelectric dams are infamous for displacing local communities, particularly indigenous communities who may rely heavily on the surrounding environment for daily living. This again shows the conflict between the economic development of the country at large who benefits from self-sufficiency and less reliance on fossil fuels, and those local communities whose standard of living may decline as a result of macroeconomic policy. These smaller sub-strata's of the population may be in too small a number to mount significant resistance to the programme, as was discussed with smaller farmers and the reforestation PES. Yet citizens of Costa Rica have benefitted from lower and more stable energy prices compared to their central American neighbours, where privatisation of the energy industry has been more aggressive than in Costa Rica. A Government has the ability to set energy prices below the cost of production as well as delay any increases in the price (Lindo 2006). This will benefit poorer communities who are likely to spend a higher proportion of their income on electricity.

It is clear that an emphasis on renewable energy is better economic than environmental policy, the question of how it affects the environment now lies over the trade-off between fossil fuel use and the environmental damage induced by hydroelectric use, which is difficult to quantify given it is not simply a matter of carbon dioxide production. In terms of the reforestation programme, there are major design errors in the programme restricting not just the economic success of the programme but also its environmental ambitions. The renewable energy programme is by no means perfect yet the rapid dependency on renewable energy over fossil fuels has shown the success of its implementation. The programme is also responsible for the knock-on economic benefits through aiming to establish a self-sufficient energy industry; there are benefits on construction and a general expanse of the energy industry. The reforestation programme needs a change of design to be considered a success and needs to be more supportive of smaller landowners whether that be through increasing the payment or redesigning it to benefit landowners in the long term.

### Conclusion

This is a question of how to use governmental resources to benefit the long-term interest of the country. Both policies will clearly help Costa Rica to decarbonise, yet when focusing on long-term economic development the literature indicates renewable energy is a better designed programme for this. Increasing renewable energy can be considered good economic policy for Costa Rica, despite being contentious environmental policy. By comparison the reforestation programme is first and foremost environmental policy whose benefits are not distributed evenly and appear to negatively impact poorer farmers more than larger landowners making it economically regressive. As a result from an economic development perspective it would be more efficient for Costa Rica to place greater policy emphasis on renewable energy production.

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