Climate Risks Assessment

Potential Impacts of Climate Change on Forest Plantation Species in Sarawak, Malaysia

Climate changes that are predicted to occur over coming decades have been studied and documented by the Intergovernmental Panel on Climate Change (IPCC 2013). Mean global temperatures have risen by 0.85°C over the period from 1880 to 2012, change which is largely attributed to mankind's emissions of greenhouse gases (IPCC 2014). If such emissions continue at their present rate, which is 'the worst-case scenario', the IPCC predicts that global temperatures will rise by an average of about 4°C by 2100 compared with a 1986–2005 baseline (IPCC 2014). Over shorter time horizons, IPCC has predicted that average temperature in Malaysia (and elsewhere) will rise by at least 1.10 and 1.96 °C by 2030 and 2050 respectively, relative to a 1986–2005 baseline (IPCC, 2014).

Potential impacts of these predicted climate changes on the planting domains (i.e. areas environmentally suitable) for key plantation forest tree species in Sarawak and elsewhere in SE Asia have been examined in detail in several studies published over recent years in reputable, peer reviewed, international scientific journals (Booth 2013; Booth et al. 2014; Booth et al. 2018; Ouyang et al. 2021). In these and other studies, the potential impacts on planting domains have been examined for average temperature increases of 1.10, 1.96 and 3.83°C by the end of the century (compared against the 1986–2005 baseline used in the IPCC (2013)), corresponding roughly to what might be expected if the implementation of the Paris Agreement is largely effective, partially effective or largely unsuccessful respectively.

Assuming a ''business as usual'' climate change scenario (i.e. no significant reduction in greenhouse gas emissions) resulting in average temperature increases of 3.83°C by the end of the century, climate change impacts on the planting domains of key plantation species in Sarawak are expected to be low through to 2030. But, impacts will likely become medium by 2050 and high by 2080 as some current plantation sites increasingly will start to fall outside the range of conditions known to be climatically suitable for some, but not all, key species (Booth et al. 2014; Booth et al. 2018).

However, if all countries can collaborate to keep global temperature increases below 2°C relative to preindustrial conditions, the vulnerability of the planting domains of Sarawak's key plantation species – including those of Falcataria, Gmelina, Eucalyptus and Acacias – to long-term climate change are likely to be low.

Even so, it must be understood that predicting the effects of changing environmental conditions on planting domains and yields of forest plantation species is complex. Changing climatic conditions are likely to not just affect species planting domains, but also the risks of pest, disease and weed problems (Booth et al. 2015), so complex interactions may well produce surprises. Also, climate changes may well result in productivity of plantations increasing at some locations as they start to benefit from atmospheric as well as climatic changes. For example, a study that investigated the effects of increasing temperatures and increased atmospheric carbon dioxide on Acacia plantations in Southern Vietnam estimated that a 2°C temperature rise and a 500 ppm CO_2 atmosphere (up from a then level of 360 ppm, compared to recent levels of 400 ppm) could increase growth by up to 20 per cent (Booth et al. 1999).

Overall vulnerability of Sarawak's key forest plantation species such as Gmelina, Falcataria, Eucalyptus and Acacia species to climate change is a function of potential impact and adaptive capacity (see Booth 2013). Managers of plantations of such species in Sarawak have a high degree of adaptive capacity, as their plantations are often grown on short rotations of 12 years or less and so the opportunity to change genetic material/species occurs much more frequently than for genera such as Pinus that are often grown in temperate countries on rotations of 30 years or longer. For plantations in Sarawak, if climate change does start to cause problems, it will be relatively quick and easy for plantation managers to change the genetic varieties or taxa planted to those better suited to higher temperatures. This could be achieved by selecting varieties and clones more tolerant of higher temperatures and/or by introducing genes – through hybridisations – from other closely related species.

Forest plantation managers in Sarawak also have considerable flexibility in management factors other than just species/genotype selection to respond to changes in climatic and other environmental conditions. These include through site selection, stand management (including reducing the impacts of drought), fire management, pest/disease/weed management, establishment strategies and use of more recent climatic data to assess risks (e.g. relying more on climatic data from the last 20 years for planning, rather than long-term mean data based on the last 100 years).

Key References

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