

Exotic plantation forest: A green desert?

Tree plantations may have many benefits over other industrial land uses, but there are ecological costs, whether present, or potential. It will be not wise to replace one unsustainable system with another. Putting all our eggs in the monoculture basket does not make sense. Alternative species and ecologically sustainable forestry systems must be pursued as a safeguard.

DR. MD. MIZANUR RAHMAN

PLANTATIONS are done for several reasons including timber and fire wood production, soil and water conservation, and carbon sequestration. The role of plantations for biodiversity acceleration varies considerably depending on whether the original land cover is grassland, shrubland, primary forest, secondary forest, or degraded or exotic pasture, and whether native or exotic tree species are planted. The plantations can support biodiversity when they are established on degraded lands rather than replacing natural ecosystems like forests, grasslands, and shrublands, and when indigenous tree species are used rather than exotic species.

The dominance of exotic species is attributed to increased disturbance, changes in light and soil conditions, and, in some cases, changes in land management, including exclusion of grazing. The changing amounts of exotic versus native species reflect the community structure. Exotic plantations are less species rich than natural and semi-natural ecosystems (shrublands, grasslands, primary, and secondary forests). Exotic plantations support a less diverse flora and fauna compared to native plantations.

In most cases the influences of exotic tree plantations on some environmental parameters such as soil biogeochemistry are still largely unknown. Some species degrade soil organic matter and adversely affect soil flora and fauna. Sometime soil nutrients decline, and whole tree harvesting causes accelerated soil nutrient loss. Many exotic species are also detrimental to critical environmental factors such as soil physical properties.

Exotic monoculture tree plantations do not help to maintain landscape and biological diversity. Uniform rows of monocultural plantations are the opposite of diversity. Diversity is considered to be the primary indicator of ecosystem sustainability. Exotic trees have been found to be poor habitat for native birds. Nesters, insectivorous, and other birds that feed on fruit and nectar are particularly absent from exotic plantations. Some exotic plantations act to cut off islands of remnant indigenous forest from each other, reducing the chances of native species populations exchanging genes.

Exotic monocultures increase fire risk and can act as a source of pests and pathogens that spread into adjacent indigenous forest. Around the globe monocultures have been found to be susceptible to pests and diseases. With the narrowing of tree genetic material, increased resistance to various pests and diseases, and increased pesticide use, there is the longer-term risk that

nature will retaliate and produce a whole new mutated set of insects, fungi and bacteria.

The living part of the soil is particularly sensitive to changes in pH. There is evidence of acidification under some exotic plantations. The nutrient removal associated with fast growing exotic plantations cause nutrient depletion of the soil and lower productivity.

Some exotic species can be aggressive pioneer by invading adjacent ecosystems. Invasive species are characterised by having abundant and easily dispersed seed, experiencing little competition when invading new areas having an absence of natural predators and successful establishment of mutualistic relationships.

Afforestation with exotic species alters habitat substantially for native flora and fauna with particularly strong negative effects on specialist grassland and shrubland species. Invasive exotic species compete with indigenous species and change ecosystem functioning. Environmental stress from nutrient decline and climate change will likely cause a decline in the health of monocultural tree plantations.

On the other hand, exotic plantation forests can result in rapid development of a forest structure beneficial for some wildlife species though it has less developed understorey due to the intensity of site preparation and frequent uniformity of plantation forest structure, and can change ecological processes through litterfall and decomposition. Exotic plantations provide wildlife corridor to connect with the natural ecosystems. It is obvious that exotic plantations are far better than agriculture or urban development. Sometimes, exotics can have understorey resembling native forests.

Though exotic plantations do very little to conserve biodiversity, but they act as carbon sinks and conserve soil from further degradation. It is certain that higher level of biodiversity than human-modified landscapes. Exotic plantations may also support some endangered faunal species providing an alternative habitat. It often supports fewer specialist species and can play an important role in biodiversity conservation at the landscape level.

To potential economic revenue, exotic plantations can help restore the degraded areas where native regeneration or native plantations may otherwise be inhibited. It improves soil condition through litter production and adding humus. Through timber production, carbon sequestration and other services for ecosystem, exotic plantations of denuded lands with low biodiversity can continue to provide economic revenue. The role of exotic plantations in soil and water quality, yield, biodiversity and ecosystem



health cannot be ignored. They are efficient at storing carbon dioxide in biomass and can be considered as the carbon sink.

An exotic plantation may produce an increase in diversity if planted into introduced grass or crop lands, or on severely degraded areas, as trees tend to increase the vertical complexity of vegetation and the structural complexity of a landscape. The tree can reduce soil erosion and cause sedimentation in adjacent water courses. Plantations can help reduce storm and peak flood water levels. They reduce stream flows working against huge erosions and act as a shelterbelt in the coastal areas. Exotic plantations in the riparian strips are currently the major area offering biodiversity protection. It can play for both diversity of stream fauna and water quality, and for providing biodiversity reserves within catchments.

Exotic plantations generally increase diversity compared to fallow, denuded, degraded, pasture and croplands. It is noteworthy to mention that exotic forests are also source to timber, industrial fibre, building materials, and provide recreation and wildlife habitat to some extent. Following the clearance of our maximum native forests, largely into agricultural lands, any type of tree plantation can be considered as the emerging major land use. Undoubtedly there are benefits from planting trees on areas of introduced pasture and cropland, such as improved protection for soils and reduced erosion, better water quality, and increased vegetation complexity.

Exotic trees can also act as a 'filter' of the atmosphere, exchanging various gases as well as air-borne particles such as dust and rain. Some exotic trees have biological relationships that fix nitrogen from the air, as do some free growing soil bacteria and fungi. Exotic trees can contribute variable quantities of litter (dead plant matter) to the soil organic matter. This litter varies in its chemical composition, the force with which it breaks down on the soil, and the diverse range of soil flora and fauna that inhabit it. The byproducts of the litter breakdown are retained in the soil through chemical and biological processes. Nutrients such as phosphorus, nitrogen, potassium, calcium, magnesium and trace elements may be retained in a form that is not available for tree and plant growth (fixed pool), or may be in the

plant available 'pool'.

Forest canopies tend to moderate soil temperatures, with further insulation from forest floor litter layers. Soil aeration can be altered by the tree roots, through them 'breathing' or decomposing, and by changing soil porosity and density, and possibly structure. Many exotic species do not negatively impact on soil but actually benefit it. It is well known to all that any tree has some benefits to the soil, such as inception of dust, protection from the kinetic energy of rain, preventing some types of erosion, and moderation of temperature.

We need to restore the forests. There has been a call by the wood industry for massive global planting programmes to meet an expected demand for wood. But the industry should pause for a minute and put aside the profit margins, and should ask themselves whether the exotic plantation can fulfil the criteria of sustainability or not. Tree plantations may have many benefits over other industrial land uses, but there are ecological costs, whether present, or potential. It will be not wise to replace one unsustainable system with another. Putting all our eggs in the monoculture basket does not make sense. Alternative species and ecologically sustainable forestry systems must be pursued as a safeguard.

Mixed plantations can play the role of 'greenwash' in the ecosystems. A considerable number of combinations are possible; usually planting higher value timber trees such Eucalypts, Acacias, Mangium and Bokain in a long rotation with selective felling regimes. The mixed species will be more responsive to site conditions, allowing the maximum use of site diversity and individual species requirements. They will provide more and better quality habitat for wildlife and if planted through a landscape plan, be more visually attractive and interesting. Woodlands could be established as patches within a predominantly agricultural landscape to assist the transition to a protected ecosystem network involving native species. However, exotic plantations can support biodiversity to some extent, even when compared to primary forest, and should not necessarily be considered as 'green deserts'.

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GLOBAL WARMING Bangladesh case

Although the conferences since 1992 have generated hope that world leaders understand the consequences of devastating effect of climate change, but the hope that generated at Earth summit in 1992 or at Johannesburg in 2003 are fading. Today's planet earth would have already been a safer place if recommendations were implemented by now.

MOHAMMAD AMJAD HOSSAIN

GOD has given a beautiful planet to the people to live in, but their misdeeds over a few past decades have made it unsafe for them. What a paradox! Yes, the scourge of human induced climate change is there.

As Cancun conference under United Nations framework convention on climate change has indicated (held from 26 November to December 10), it had encompassed 83 sessions. In addition, four international conferences also took place on climate change, but no remedial measures are in sight as taken either by the industrialised countries or by the developing countries. By now population is continuing to grow by leaf and bounds. Only assurances have heaped.

This being the scenario a seminar was organized on "Save our planet earth from global warming and climate change" with particular emphasis on Bangladesh at Bangladesh Embassy in Washington DC on December 14. Under the chairmanship of Ambassador Akramul Qader. It was participated by Greg Vitali, House Representative from Pennsylvania, Jonathan Porter, Policy Director to US congressman Joseph Sestak, Jim Dougherty, Executive Secretary and environmental lawyer from DC chapter of Sierra Club, Robert Shapiro, Chairman, Sonecon and former Under secretary of department of Commerce, Abu Amin Rahman, Scientist from Merck and company, Pennsylvania, and Muhammad A. Azim, Revenue analyst, Department of Revenue of Pennsylvania. The key note speaker was Lance Simmens, Special Assistant to Governor of Pennsylvania on Intergovernmental affairs, who was Climate messenger of former Vice-President Al-Gore. Simmens gave a very powerful graphic power point presentation on the gradual degradation of environment which led to global warming.

Ambassador Akramul Qader pointed out that Bangladesh has adopted a national programme of action and climate change strategy. This includes reducing modest emissions level (0.3 percent metric ton per capita). The ambassador said the government of Bangladesh has set aside a \$200 million climate change resilience fund and a multi-donor trust fund. Bangladesh wants to establish an international climate adaptation center for track record to effectively fight climate change.

It may be recalled that Bangladesh has been ranked by the International Strategy for Disaster Reduction (ISDR) as the most vulnera-

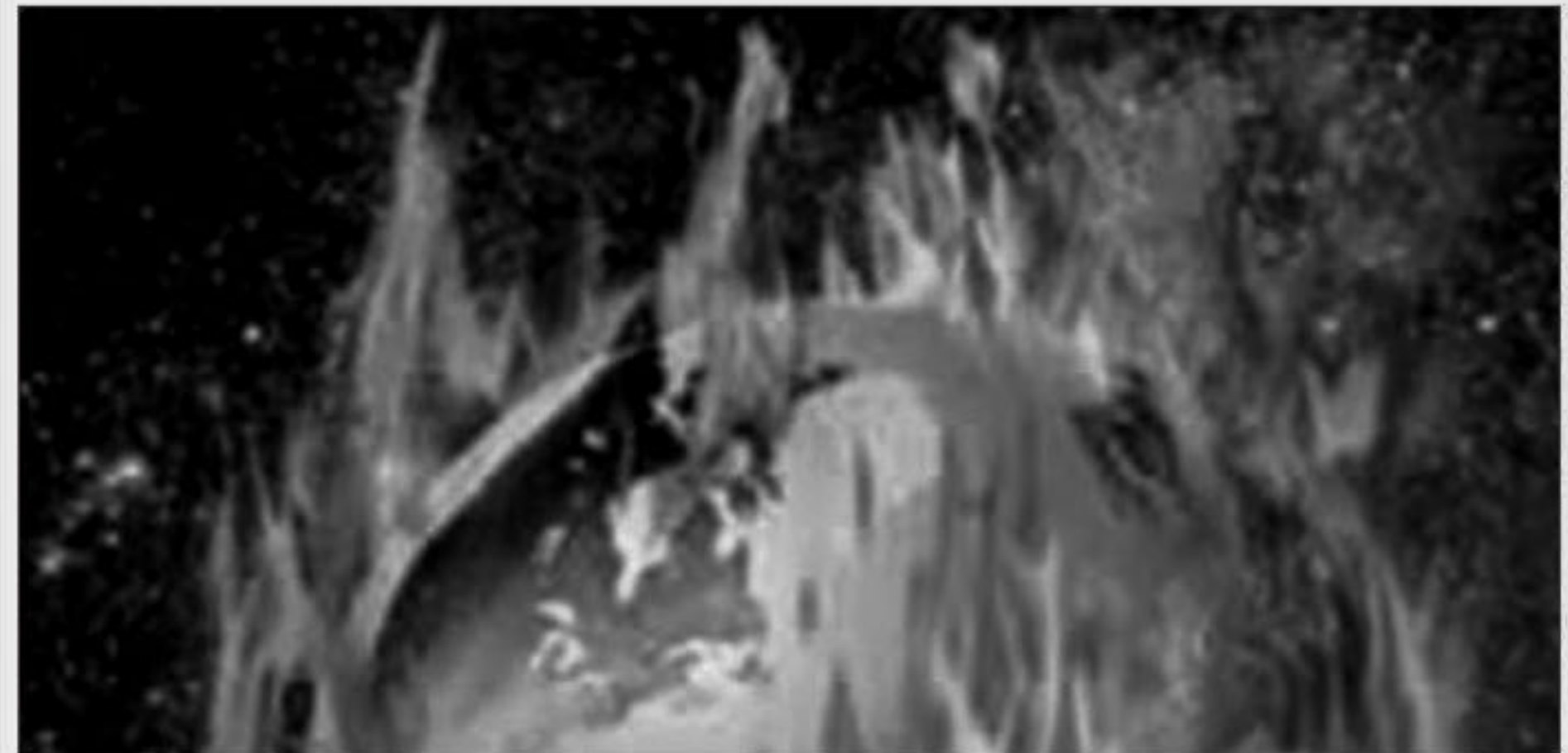
ble county to floods, third most to tsunami, and sixth most to cyclones. The UN intergovernmental panel on climate change estimates that one meter rise in sea level could place 17 percent of Bangladesh population under water by 2050. This means 20 million people would become environmental refugees, and 40 million more will lose their livelihood by 2050. Scientific estimates place a billion people would be displaced all over the world by 2050 as a result of climate change. It is from this perspective that Bangladesh has been consistently demanding for adoption of a new legal regime to ensure rehabilitation of climate refugees.

Lance Simmens also gave a graphic picture of vulnerability of Bangladesh as a result of global warming. He was of the opinion that deforestation in India and Bangladesh also contribute to the climate change. Consensus opinion of the panelists was that there was lack of political will in the western countries to address the global warming and adopt mandatory measures to mitigate the problem. Simmens commented that the United States and China should take lead in mobilizing the opinion of the danger that the planet is facing because of climate change and global warming.

After the seminar Lance Simmens confided to this writer that despite holding of international conferences by the United Nations on climate change, no effective measures were forthcoming from industrialized countries who are held responsible for climate hazards because they are held hostage at the hands of interest groups. Simmens, however, said that Obama administration seems to be on the right track on tackling the monumental environmental crisis. In response to a query from the audience Simmens said if Bangladesh is affected by global warming, other countries would also be affected directly or indirectly. Therefore, global initiative needs to be geared up to protect the projected countries.

Although the conferences since 1992 have generated hope that world leaders understand the consequences of devastating effect of climate change, but the hope that generated at Earth summit in 1992 or at Johannesburg in 2003 are fading. Today's planet earth would have already been a safer place if recommendations were implemented by now. A movement on global warming and climate change now seems imperative because of negligence made by industrialized countries to mitigate the crisis.

Mohammad Amjad Hossain, a retired diplomat from Bangladesh writes from Virginia.



Ship ballast water contaminating marine environment

Marine pollution from ship ballast water is one of the greatest threats to ocean life. Ballast water is one of the major pathways for the introduction of non-indigenous marine species. Because of the potential for ecological and economic damage posed by these organisms, ballast water should be managed to minimise the risk of species introduction.

MD ABU SAYED

BALLAST water of ships may be the source of the largest volume of foreign organisms released on a daily basis into the marine ecosystems. The ballast water has been a primary method of alien species introduction throughout the world. Scientists estimate that as many as 3,000 alien species per day are transported in ships around the world. The introduction and spread of alien invasive species is a serious problem that has ecological, economic, health and environmental impacts, including loss of native biological diversity.

What is ballast?

Ballast is defined as any solid or liquid

that is brought on board a vessel to increase the draft, to change the trim, to regulate the stability or to maintain stress loads within acceptable limits. Prior to the 1880s, ships used solid ballast materials such as rocks and sand, which had to be manually shovelled into cargo holds, and similarly discharged when cargo was to be loaded on board. If not properly secured, solid ballast was prone to shifting in heavy seas causing instability. With the introduction of steel-hulled vessels and pumping technology, water became the ballast of choice. Water can be easily pumped in and out of ballast tanks, requires little manpower, little cost and as long as tanks are kept full, poses little to no stability problems.



Discharge of ballast water from a container ship.



PHOTO: U.S. FISH & WILDLIFE SERVICE
Sea lamprey *Petromyzon marinus* (shown attached to a lake trout) led to the collapse of lake trout (*Salvelinus namaycush*) populations in the Great Lakes during the mid-20th century.

What is ballast water?

Ballast water is fresh, brackish or marine water that has intentionally been brought on board to adjust the ship's stability. Large ships often carry millions of gallons of ballast water. This water is taken from coastal port areas and transported with the ship to the next port of call where the water may be discharged or exchanged. Organisms living in size from viruses to 12 inch fish in the surrounding water or sediments are taken on board with ballast water. Most ships are equipped with a range of ballast capabilities and capacities, but generally it is 25 to 30 percent of their dead weight tonnage.

Why is ballast water an issue?

Coastal port areas are home to a wide variety of organisms that live in the water and bottom sediments. If a ship takes on ballast water in a shallow area, sediments and any associated organisms may be pumped into ballast tanks. When ballast water is released, these organisms may also be released.

The discharge of ballast water may cause the introduction of alien species which threaten the ecological balance of the surrounding sea and thereby represent a direct threat to biodiversity. There are many aquatic species that may be carried in ship's ballast water, including bacteria, viruses and other microbes, micro-algae, and various life stages of aquatic plant and animal species.

Species are considered alien if they are not native to a given ecosystem. These



PHOTO: J. ELLEN MARSDEN, LAKE MICHIGAN BIOLOGICAL STATION
A cluster of zebra mussels on a small rock.

introduced alien species, or bioinvaders, are also referred to as exotic species, non-native and non-indigenous species. Alien species are considered to be invasive when their introduction causes, or is likely to cause, harm to the environment, the economy, or human health.

At present, we can not predict which organisms will die during a long journey in a ballast tank or why some are still alive when ballast water is released. Larger organisms often survive the journey by eating smaller ones. When faced with unfavourable conditions, some microorganisms and plankton species will form spores or other tough outer coverings for protection. As a spore, an organism may survive for a long time without food or in a different salinity or temperature than its natural environment. Once the environment becomes favourable again, such as when they are discharged into a port, the organism may change back to its active form.

As said, scientists estimate that as many as 3,000 alien species per day are transported in ships around the world; however, not all transported species survive the trip and their new home or surroundings because temperature, food, and salinity are less than optimal; but, the few that do survive and establish a population have the potential to cause ecological and economic harm. These bioinvaders can cause disruptions in the natural ecosystem, economic troubles, and even carry human diseases or introduce new genetic materials which not only induce mutation in native marine organisms but also jeopardize their natural abilities.

Ecological impact

The introduction and spread of alien species into any ecosystem is highly undesirable because of the negative and irreversible changes that can result. Alien species with no natural predators can wipe out native species by altering their habitat, feeding on them excessively, or by using up a particular food source on which native species depend.

Zebra mussels are a major threat to endangered North American freshwater unionids, such as the quagga mussel (*Dreissena bugensis*) by competing for food and encrusting their shells, resulting in mortality.

Six countries near the Black Sea have been affected by the Atlantic comb jelly. It has eliminated the zooplankton in the Black Sea which has exhausted the region's anchovy fishery. Shellfish in Tasmania have been wiped out by North Pacific sea stars.

Economic impact

Until the introduction of sea lamprey (*Petromyzon marinus*) to the Great Lakes in 1955, there was no general understanding that alien species could be both an environmental and an economic problem. Sea lampreys have decimated lake trout, whitefish and chub populations in the Great Lakes resulting in severe losses to the Great Lakes' recreational and commercial fisheries. The Great Lakes Fishery Commission reported that sea lamprey control, assessment and research cost \$13.5 million in 2001.

Once the European zebra mussel introduced to Lake St. Clair in the early 1980s, zebra mussels quickly expanded their range throughout the Great Lakes and caused billions of dollars of damage.

Zebra mussels have caused tremendous problems for industrial raw water users by clogging water intake pipes resulting in significant increases in annual operating costs to the automotive industry, water purification plants, and electric power utilities. Periodically these organisms need to be removed from pipes and other structures which requires time, money, and possibly specialised equipment. The cost to keep the water intake pipes at Ontario (in Canada) Power Generation facilities clear of zebra mussels from 1990 to 2000 was estimated at close to \$44 million. The total estimated

impact on industries, businesses and communities is over \$5 billion in monetary terms.

Environmental and human health impact

Alien species can also destroy the environment and threaten human health and safety. For example, the Chinese mitten crab (*Eriocheir sinensis*), which is able to live in both fresh and salt water, was found in the lower St. Lawrence River in 2004. They can travel hundreds of miles through inland waterways and reproduce in enormous numbers, burrowing into riverbanks and causing soil erosion and destruction of levees.

The crabs are a danger to human health because they are a host of the oriental lung fluke (*Paragonimus westermani*), a parasite that can penetrate the skin or be ingested and can cause severe illness in humans and other mammals.

Through their filtering activity, zebra mussels take in hazardous compounds such as polychlorinated biphenyls (PCBs). Fish and waterfowl that eat the mussels carry those poisons into the food chain.

Some species introduced to new places through ballast water contaminate filter feeding shellfish, making them toxic and inedible. Consumption of these contaminated shellfish by humans can cause severe health problems and even death. Moreover, harmful microorganisms of various types can become more virulent as a result of contact with other organisms in ballast water.

Ballast water can also transport cholera around the world. In 1991 the South American cholera epidemic was a result of the bacterium discovered in oysters and fish in Mobile Bay, Alabama. 1/3 of the ships arriving from South America in Alabama carried this bacterium.

Conclusion

Marine pollution from ship ballast water is one of the greatest threats to ocean life. Ballast water is one of the major pathways for the introduction of non-indigenous marine species. Because of the potential for ecological and economic damage posed by these organisms, ballast water should be managed to minimise the risk of species introduction.

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