

LAND-USE CHANGES

A multidisciplinary understanding is needed to address complex issues associated with climate and land-use change patterns. For example, variability in climate can affect agricultural land-use patterns due to changes in rainfall patterns, temperatures¹ and carbon dioxide enrichment². Other potential impacts include forest fires, intensity and duration of sea level rise and floods, especially in coastal areas.

Interestingly, change in land-use patterns are also major, but poorly understood drivers of long-term global climate patterns, which have been described as being at least as important drivers in altering weather as changes in climate patterns associated with greenhouse gases³. Therefore land-use patterns invoked by human intervention, such as urbanization, de-/afforestation, industrialization, irrigation of drought-prone areas, land-filling, etc., should be considered a first order forcing factor. These factors affect the climate on scales ranging from the microscale to the macroscale⁴.

Globally, between 25 to 50 percent of our planet's land surface has been transformed by human development. In 2001, Malta's remaining area occupied by natural habitats as a percentage of total land area amounted to 19 percent⁵.

Given all the above-mentioned factors, the net impact on land used for agriculture in a particular area could be positive or negative. If climate change makes agriculture less productive in an area, then more farm land will be converted to other uses. On the other hand, if climate change makes this area more productive, then land that is currently in forests may be converted to agricultural uses.

¹ Higher temperatures are likely to make growing seasons longer, allowing the possibility of more than one cropping cycle during the same season as well as the expansion of agricultural and forest land towards the poles and to higher elevations. At the same time, increases in night time temperatures can affect biological processes such as respiration and could result in reduction of potential yields.

² Scientists are trying to understand the responses of CO₂ enrichment (higher volumes of CO₂ in the atmosphere) on different species. Wheat, rice and soybeans are crops that seem to have a positive response (increased overall observed growth) to higher CO₂ levels in the atmosphere. Crops such as corn are likely to be less responsive to CO₂ enrichment (Cure and Ackcock 1986).

³ Pielke R.A. Sr., G. Marland, R.A. Betts, T.N. Chase, J.L. Eastman, J.O. Niles, D.D.S. Niyogi and S.W. Running. (2002) "The Influence of Land-use Change and Landscape Dynamics on the Climate System: Relevance to Climate-Change Policy Beyond the Radiative Effect of Greenhouse Gases." Philosophical Transactions of the Royal Society of London. A360:1705-1719

⁴ One example of how land use and land cover affects global climate is the changing spatial and temporal pattern of thunderstorms. Deforestation or urbanization may influence the nature of the heat fluxes and availability of water vapor.

⁵ Rural Topic Paper, Volume 1. Final Draft, March 2003. Malta Structure Plan, Mepa.

Salient impacts:

1. *Major coastal areas prone to the impact of sea level rise and storm surges include the Northeast coast of Malta, North and Southeast cost of Gozo, as well as the Northern coast of Comino⁶. Natural protected areas are extremely vulnerable to this phenomenon.*
2. *Drought stresses are expected to lead to changes in land-use patterns due to changes in agricultural practices, land abandonment and depletion of groundwater sources, negatively impacting our rural economy.*
3. *Many areas in Malta are prone to climate change impacts. High rise buildings are especially prone to strong winds and future planning and design needs to focus on these issues.*
4. *Climate change impacts may impact property values, leading to changes in property insurance premiums.*
5. *Projected increase in the impacts on terrestrial and aquatic plants, resulting in loss of biodiversity, especially in designated protected areas.*

⁶ According to The Second National Communication of Malta to the United Nations Framework Convention on Climate Change (2010), the total land that will be affected is 1.11km² or 0.36% of the total surface area of the Maltese Islands.

Phenomenon	Groundwater	Agriculture	Coastal zone	Urbanisation	Infrastructure	Industry
Increased air temperature	High probability that groundwater recharge will be reduced.	More aggressive regime for agriculture will be applied. New opportunities sought to increase opportunities for premium products maturing early, affecting crop diversity.				
Increased frequency of heat-waves	Water flows are expected to reduce, drying up of reservoirs and ground water levels drop.					
Increased torrential rains, flooding and severe storms		Increased water logging, ponding and surface scour expected to lead to increased likelihood of soil erosion. Increased rate of nutrient reduction from surface soils due to sheetwash processes.	Increased risk to coastal communities, requiring expensive adaptation measures. Increased storm surges may jeopardize plans for coastal developments including future land reclamation projects.	Increased incidence of flooding, which may require relocation of existing land uses or the modification of existing infrastructure, or construction of special infrastructure to alleviate this problem. Increased flooding of the sewerage systems in places, causing contamination of water supplies and agricultural areas.	Projected increased of floods. Projected increased damage to infrastructure.	
Sea level rise			Increased coastal inundation, erosion, inland migration of beaches, increased potential damage from storm surges and tsunamis, reduction in slope stability where blue clay formation outcrops at sea level.	Increased risk to coastal communities, requiring expensive adaptation measures.	Increased loss of land. Projected increased flooding of coastal areas. Projected increased investment for flood defenses. Projected increased risk to transport infrastructure, including arterial roads.	Requirement for new construction methods. Insurance premiums may increase. Increased impact on commercial and industrial activity expected to be located along the eastern low-lying coastal area.

