





















**FOREST PRODUCTIVITY: recommended adaptation actions**

CLIMATE CHANGE IMPACTS AND RISKS	MANAGEMENT ACTIONS	RESPONSIBILITY
Reduced yields of forest products due to changes in temperature or precipitation	Adjust management plans to account for reduced yield expectations	
	Adjust harvesting schedules (e.g. hunting seasons, cutting cycles and non-wood forest product collection)	  
	Modify silvicultural treatments (e.g. thinning, pruning and vine-cutting)	
	Modify rotation lengths or cutting cycles, taking into account cost, technological and market implications	
	Match species and varieties to current and projected site and climatic conditions. In <i>planted forests</i> , use species and varieties that are adapted to new and anticipated conditions. In <i>natural and semi-natural forests</i> , favour varieties and species that are adapted to current and predicted future climatic conditions by selecting and retaining seed trees and through enrichment planting	  
	Adapt primary management objectives to allow the use of the existing or affected crop for other purposes (e.g. switching from timber production to pulp, woodfuel or poles)	
	Invest in measures (e.g. reduce grazing and maintain organic matter) to improve soil structure and reduce water stress	 
Increased yields of forest products due to higher temperatures or precipitation	Manage vegetation (e.g. control weeds and understorey vegetation) to reduce drought stress	
	Consider diversifying management objectives to include other products and income-generating activities	
	Adjust harvesting schedules (e.g. hunting seasons, cutting cycles and non-wood forest product collection)	  
	Modify rotation lengths or cutting cycles, taking into account cost, technological and market implications	
	Adjust silvicultural treatments accordingly (e.g. thinning, pruning and vine-cutting)	
	Manage vegetation (e.g. control weeds and understorey vegetation) to reduce competition with target species	



(species)  
(varieties)

















**BIODIVERSITY: recommended adaptation actions**

CLIMATE CHANGE IMPACTS AND RISKS	MANAGEMENT ACTIONS	RESPONSIBILITY		
Change in the viability of species and varieties in the managed area	Adjust management plans to take into consideration changes in species distribution (e.g. reduce logging intensities and hunting pressure on affected species)			
	Manage for diverse tree composition, age and structure and understorey vegetation at the stand and landscape levels			
	Plant or promote the use of climate-adapted species and varieties			
	Establish or expand and manage protected areas to conserve vulnerable species and habitat types			
	Protect species at the edges of their ranges because they may be better adapted to new climatic conditions			In areas of reduced rainfall, maintain connections between waterways to avoid drying up
	Provide corridors of suitable size and habitat to allow species migration and otherwise maintain landscape connectivity			Implement measures to ensure proper drainage and erosion control in areas subject to waterlogging (e.g. adjust the construction and maintenance of roads and stream crossings)
	Assist the movement of species through the restoration and conservation of migration routes and the reintroduction of species			<b>Forest fragmentation</b> Maintain landscape connectivity and establish corridors through restoration and reforestation
	Adjust hunting and fishing to levels that are sustainable under new climatic conditions			
	Promote extensive grazing management for livestock to prevent overgrazing and encourage regeneration			
	Species moving into a management area	Where appropriate, promote the establishment and management of beneficial species moving into a forest area		
Put measures in place to detect and control invasive species				
Aquatic species declining	In areas of increased rainfall, decrease the risk of erosion (and consequent decrease in water quality) by increasing the protection of riparian zones and watersheds			
	Maintain or increase shade in riparian zones where increased temperatures pose a risk to aquatic species (e.g. by increasing tree cover and favouring fruit-bearing species)			

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**WATER AVAILABILITY AND QUALITY: recommended adaptation actions**

CLIMATE CHANGE IMPACTS AND RISKS	MANAGEMENT ACTIONS	RESPONSIBILITY
<b>Water scarcity/ stress and increased drought</b>	Sustainably manage water resources to ensure water storage, the regulation of water flow and the provision of water to downstream users (e.g. through the protection of forest catchment areas, water harvesting and the protection of streams)	 
	Promote water infiltration of the soil, the water-storage capacity of soils and water-trapping in catchments, storage lakes and irrigation channels (e.g. using check dams, retention ditches and contour and strip cropping)	 
	Undertake watershed management to ensure the delivery of clean and reliable water	  
	Select water-efficient and drought-resistant species and varieties for afforestation and reforestation	   
	Reduce evapotranspiration and competition for water by vegetation management (e.g. thinning, pruning and planting deciduous species)	
	Maintain forests on ridge tops to promote mist and fog interception, reduce surface runoff and increase water infiltration of the soil	 
	Promote afforestation and reforestation to protect against wind erosion (e.g. establish windbreaks)	 



**Increased precipitation and changes in seasonal rainfall patterns**

Adjust harvesting schedules to reduce erosion and siltation, taking into consideration the terrain, forest cover, road networks, the type of machinery used and the presence of streams and other waterways



Implement measures to ensure proper drainage and erosion control in areas subject to waterlogging (e.g. provide drainage channels and adjust the construction and maintenance of roads and stream crossings to ensure proper drainage)



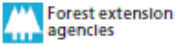
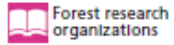
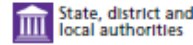
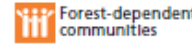
Maintain or increase vegetation cover in erosion-prone and flood-prone areas (e.g. use contour and strip cropping)



Consider excluding harvesting in areas subject to waterlogging



Plant or encourage species and varieties capable of benefiting from or withstanding increased rainfall and waterlogging. In the case of mangrove forests, consider interventions to maintain salinity levels and adjust to increased alluvial deposits



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**FIRE: recommended adaptation actions**






CLIMATE CHANGE IMPACTS AND RISKS	MANAGEMENT ACTIONS	RESPONSIBILITY				
Increase in the number, frequency, size or severity of wildfire	Obtain available information on the increased risk of fire due to climate change (e.g. from research organizations, forestry associations and agencies, and local and regional governments)			Protect fire-sensitive ecosystems through landscape planning and management, with a prevention focus		
	Assess the impacts of climate change on fire occurrence and behaviour at the landscape level			Modify landscape structure to impede fire spread (e.g. establish networks of fire breaks; manage for a mix of stand ages and stocking densities; thin stands; create mosaics of controlled burns; select fire-tolerant species)		
	Support the development of policies and plans for forest fire management			Maintain and restore appropriate fire regimes to increase forest resistance to severe fire		
	Ensure the inclusion of integrated fire management in local and regional planning			Use prescribed burns and "let burn" policies in fire-maintained ecosystems for fuel management and to achieve ecological management objectives		
	Integrate fire management considerations with forest management planning (e.g. assess the quantities of potential fuel during monitoring to assess fire risk)			Minimize the harmful environmental impacts of fire suppression activities		
	Establish or improve early-warning and rapid-response systems for fire using electronic (e.g. cell phone, radio, television and email) and social media, as well as traditional communication means			Undertake salvage logging to remove dead or damaged trees that pose a fire risk		
	Employ an integrated fire management approach that emphasizes landscape planning			Promote fire-smart landscapes (e.g. by planting fire-resistant tree species as firebreaks)		
				In production forests, employ reduced impact logging to limit logging gap size and minimize logging damage and waste to reduce vulnerability to fire		
			Reduce or avoid the burning of logging residues in fire-prone areas			
			In areas where slash-and-burn agriculture poses a fire risk, encourage the modification of burning practices (e.g. restrict burning to seasons where the risk of fire is low)			
			Avoid draining peatlands and other wetlands with organic matter-rich soils			
			Recognize, respect and promote the use and dissemination of traditional and ancestral fire management practices			
			Monitor methods and techniques for fire management for future planning, and assess the results of these methods			

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PESTS AND DISEASES: recommended adaptation actions
























CLIMATE CHANGE IMPACTS AND RISKS	MANAGEMENT ACTIONS	RESPONSIBILITY	
Increased outbreaks of insects, pathogens and invasive native and exotic plant species	Conduct regular surveys to facilitate the early detection and assessment of outbreaks	  	
	Identify forest areas vulnerable to pests and diseases (e.g. map vulnerable forest areas)	 	
	Employ integrated pest management to prevent and suppress attacks	   	
	Adjust harvesting schedules to harvest affected or vulnerable stands to reduce the risk of pest outbreaks		
	Minimize damage to trees during harvesting, silvicultural interventions and fires to minimize the risk of pest outbreaks		
	Maintain stand and tree health to increase resistance (e.g. by thinning to reduce water stress)		
	Encourage the introduction and maintenance of mixed-species stands to increase resistance to pest invasion and resilience	  	
	In forest stands, introduce and retain genotypes and varieties that are resistant and resilient to pest attack	   	
	Avoid pest infestations by using good phytosanitary practices (e.g. the use of gloves when handling seeds and seedlings)		
	Avoid the introduction of pests and diseases by humans, domesticated animals and heavy equipment		
Properly dispose of infected harvesting and silvicultural waste (e.g. by controlled burning or the use of residues for bioenergy production)			
Support awareness-raising and training exercises for forest workers to promote the early detection and management of pest and disease outbreaks	  		

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## EXTREME WEATHER EVENTS: recommended adaptation actions

CLIMATE CHANGE IMPACTS AND RISKS	MANAGEMENT ACTIONS	RESPONSIBILITY
<b>Increased flood frequencies and intensities</b>	Improve early-warning systems and the level of communication among local stakeholders	 
	Protect headwaters through watershed protection and management interventions	  
	Ensure unimpeded water flows by keeping rivers, creeks and streams free of debris and blockages	 
	Maintain natural vegetation in riparian zones and avoid the channelization of headwater streams	
	Design and build infrastructure with larger safety factors (e.g. forest roads with proper drainage and dams with higher storage capacity)	 
	Ensure the adequate maintenance of road networks, particularly in areas with steep slopes	 
	Avoid the use of heavy equipment on steep slopes and riparian areas	
	Avoid soil compaction to maintain infiltration rates and the water-storage capacity of the soil	
<b>Increased storm intensities and frequencies</b>	Adjust rotation lengths and cutting cycles to minimize the risk of storm-induced damage (e.g. landslides or runoff due to reduced vegetation cover)	
	Modify harvesting regimes to improve species and stand stability	
	Avoid clear-cutting in vulnerable areas	
	Maintain or increase species and structural diversity in ecosystems to promote resistance to storm damage and resilience following damage	 
	In areas experiencing increased snowfall and ice storms, consider favouring hardwood species over conifers to reduce the risk of breakage from snow and ice	
	Select wind-resistant species and promote the development of multilayered canopies	  



<b>Increased likelihood and size of landslides</b>	Adhere to established road-siting and harvesting regulations and best practices for steep slopes and other areas prone to landslides and erosion (e.g. codes of practice and guidelines)	 
	Maintain continuous vegetation cover on steep slopes	  
	Promote multilayered root systems by encouraging growth (e.g. through natural regeneration or planting) of deep-rooted and shallow-rooted species	 
<b>Increased risk of coastal surges</b>	Practice contour planting	
	Avoid soil disturbance in unstable areas	
	Maintain and restore mangroves and other coastal forests as buffers	 



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**SEA-LEVEL RISE: recommended adaptation actions**

CLIMATE CHANGE IMPACTS AND RISKS	MANAGEMENT ACTIONS	RESPONSIBILITY
Sea-level rise and storm surges	Protect or increase freshwater and sediment inputs from inland sources	  
	Employ salt-tolerant species for restoration, reforestation and afforestation	   
	Remove impediments to the migration of plant and animal species, or assist species in migration (e.g. managed relocation)	   
	Improve early-warning systems and communication among local stakeholders	  

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