

**Appendix 4.** Details of how scales of ecosystem service management were identified

**Table A.4.1: Management of landscape engineering**

Ecosystem service	Landscape engineering			
	Actions		Rules	
	Managers*	Scale	Managers*	Scale
Crop production	Farmers prepare and clear land for crop production	Site	Municipalities share responsibility with province for regulating land use	Local (municipality)
			MRC Vallee-du-Richelieu manages land use and agricultural water drainage	Regional
			MAPAQ regulates agricultural infrastructure, sanitation & hygiene	Regional
			CREM works with municipalities to develop Agenda 21 on sustainable development	Local (municipality)
			CPTAQ regulates activities in agriculture zoned lands	Regional
Pork production	Farmers build infrastructure, grow crops for feed, distribute manure on land	Site	Municipalities share responsibility with province for regulating land use	Local (municipality)
			MRC Vallee-du Richelieu manages land use	Regional
			MAPAQ regulates agricultural infrastructure, sanitation & hygiene, animal health	Regional
			BAPE provides recommendations to municipalities, province on pork production management	Regional
			Citizen groups lobby for regulation, location of pork production facilities	Local (municipality)
Drinking water	Farmers install drainage, clear land near water, alter hydrology	Site	Municipalities have complete jurisdiction over management of drinking water and restoration of surface water quality	Local (municipality)

	Municipalities install infrastructure beside rivers	Local (municipality)	Provincial government (MAPAQ) establishes policies on water	Regional
	Province, CREM, Nature Conservancy, Nature-Action clean and stabilize shorelines, clean riverbeds	Site to local (landscape)	Watershed organization (COVABAR) advocates water management CREM works with municipalities to develop Agenda 21 on sustainable development	Regional (watershed) Local (municipality)
Maple syrup production	Farmers clear brush, tap maple trees	Site	Municipalities share responsibility with province for regulating land use	Local (municipality)
			MAPAQ regulates agricultural infrastructure	Regional
Deer hunting				
Nature appreciation	For some species and habitats, restoration projects serve to enhance this service, but this is rare to date	Local	Municipalities regulate land cover change in parks	Local (municipality)
			MDDEP, MRNF regulate land cover change in provincial protected areas	Regional
			CREM works with municipalities to develop Agenda 21	Local (municipality)
			<b>MRNF regulates 'Loi sur la conservation et la mise en valeur de la faune' which outlines what is permitted in nature areas</b>	Regional
Tourism	Tourism operators build infrastructure, enhance related services such as landscape beauty, floral biodiversity, alter land cover and topography	Site	Municipalities have partial control over regulation of tourism operations	Local (municipality)
	CREM and Nature Conservancy clean and stabilize shorelines	Site to local	Tourisme Quebec shares regulation of tourism operations	Regional
Summer cottages	Land owners clear land, enhance related services such as biodiversity, shade	Site	Municipalities for regulate residential land use	Local (municipality)
Forest	Land owners clear underbrush in	Site	CREM works with municipalities to develop	Local

recreation	some cases, create trails or paths		Agenda 21 on sustainable development, including forest management	(municipality)
	Municipalities, provincial government and NGOs (CNMSH) build and maintain trails in protected areas	Local (landscape)	MRNF, CNMSH develops management plans for pests and fires in forested areas, works with private forest owners on land management issues	Local to regional
	MRNF manages pests, fires in forested areas	Regional		
	Nature-Action restores natural lands	Local (municipal)		
Carbon sequestration				
Soil retention of phosphorus	Land owners (farmers and other residents) input fertilizers into soil	Site	Provincial government regulates phosphorus inputs to soil	Regional
Soil organic matter	Land owners (farmers and other residents) input organic material into soil	Site		

**Table A.4.2: Management of access to ecosystem services**

Ecosystem service	Access to service			
	Actions		Rules	
	Managers	Scale	Managers	Scale
Crop production	Farmers protect private property	Site	CPTAQ regulates activities in agriculture zoned lands	Regional
Pork production	Farmers protect private	Site	MAPAQ awards permits for pork farming	Regional

	property			
Drinking water	Municipalities and MRC Vallee-du-Richelieu build and maintain water distribution infrastructure	Local (municipality)	Municipalities have complete jurisdiction over access to drinking water	Local (municipality)
Maple syrup production	Farmers protect private property	Site	CPTAQ regulates activities in agriculture zoned lands	Regional
Deer hunting	Land owners protect private property, negotiate with hunting organizations for access to land	Site	MRNF distributes hunting permits, runs licensing tests, registers kills, develops management plans including establishing deer hunting quotas, seasons	Regional
Nature appreciation	Land owners protect private property	Site	CREM works with municipalities to regulate access to wetlands	Local (municipality)
	CREM, CNMSH, municipalities, MDDEP build trails, facilitate access to public wild areas	Site to local	CPTAQ regulates activities in agriculture zoned lands	Regional
Tourism	Bonjour Quebec, municipalities promote tourism sites to enhance access	Local to regional	CPTAQ regulates activities in agriculture zoned lands	Regional
			Bonjour Quebec regulates tourism promotion, develops criteria for categorization and promotion of tourism sites	Regional
Summer cottages	Land owners protect private property	Site		
Forest recreation	Land owners protect private property	Site	CREM works with municipalities to regulate access to forested areas	Local (municipality)
	CREM, municipalities, MDDEP build trails, facilitate access to public wild areas	Site to local	CPTAQ regulates activities in agriculture zoned lands	Regional
Carbon				

sequestration				
Soil retention of phosphorus			Provincial laws now regulate phosphorus inputs on agricultural land, which theoretically allows people within watersheds access to this ecosystem service.	Regional
Soil organic matter				

**\*16 important ecosystem service managers in case study area of Mont Saint-Hilaire Man & Biosphere Reserve**

MDDEP: Québec Ministère du Développement durable, de l'Environnement et des Parcs

MAPAQ: Québec Ministère de l'Agriculture, des Pêcheries et de l'Alimentation

COVABAR: Comité de Concertation et de Valorisation de la Rivière Richelieu

MRNF: Québec Ministère des Ressources naturelles et de la Faune

CREM: Conseil régional de l'environnement de la *Montérégie*

CPTAQ: Québec Commission de Protection du Territoire Agricole

MAMROT: Québec Ministère des Affaires Municipales, des Régions et de l'Occupation du territoire

BAPE: Québec Bureau d'Audiences Publiques sur l'Environnement

Nature Conservancy Québec: Non-Governmental Organization focusing on conservation

Nature-Action Québec: Non-Governmental Organization focusing on conservation

CNMSH: Centre de la Nature Mont Saint-Hilaire:

Municipalities: Saint-Antoine-sur-Richelieu, Saint-Denis-sur-Richelieu, Saint-Marc-sur-Richelieu, Saint-Charles-sur-Richelieu, Saint-Mathieu-de-Beloeil, Beloeil, Sainte-Marie-Madeleine, Mont-Saint-Hilaire, McMasterville, Otterburn Park, Saint-Basile-le-Grand, Saint-Jean-Baptiste, Saint-Mathias-sur-Richelieu, Chambly, Carignan

MRC Vallée-du-Richelieu: Municipalité Régionale de Comté - supralocal government combining municipalities in a region

Farmers: Occupying the majority of the land territory in the region

Other landowners: Occupying mostly urban and peri-urban areas in the region

Tourism operators: D