Watershed Conditions:

Land Cover

LAND COVER CHANGES

The Rideau River Watershed is a diverse landscape, home to large swaths of forest and wetland, rolling farm fields, attractive lake districts and bustling towns and cities. In 2020, woodlands and wetlands covered more than half of the total area of the RVCA's jurisdiction, followed by crop and pastureland at about 20%. Settlements (cities, towns, villages and hamlets) and transportation routes occupied another 13% of all land cover, while water covered a mere 5%.

While this sounds very positive overall, there are troubling trends when we zoom into specific areas of the watershed, particularly in the Jock and Lower Rideau subwatersheds within the City of Ottawa. There, development has increased greatly at the expense of crop and pastureland, meadow-thickets and wetland. But change is occurring in other areas as well: between 2008 and 2020, the watershed saw large increases in settlement along with substantial losses in farmland and, to a lesser extent, wetland. Woodlands also increased, largely due to regenerative forests replacing meadow-thickets and crop and pasture lands. While this increase is positive, it is undone by a significant loss of mature interior forest habitat over the same time period – leaving the watershed with many smaller woodland patches but a growing deficit of larger, biologically diverse forests that many species need to survive.

This follows a long-standing trend across the province as land was cleared for farming and early settlements and subsequent industrialization took hold in the decades and centuries after colonization. In less than 200 years, parts of southern Ontario have been altered from a predominantly forested landscape to one dominated by a wide variety of agricultural, commercial, industrial and urban land uses. South and east of the Canadian Shield, more than 70 per cent of the original woodland cover has been lost.[1]

Similar land use conversions have occurred here within the RVCA's jurisdiction, including two Ottawa River subwatersheds. This degradation of natural land covers has far-reaching implications for our ability to mitigate natural hazards like floods and erosion, sustain fish and wildlife populations, and build climate change resilience.

▲ Roads and other hardened surfaces cannot soak up stormwater runoff, allowing more water to enter local waterways and increasing risks of flooding and erosion.

Why is it important?

Natural land covers such as woodlands, wetlands, meadow-thickets and shorelines play a critical role in sustaining the watershed's hydrological functions. During a major storm or melt, if precipitation exceeds the ground's infiltration capacity, water will run along the surface, either infiltrating elsewhere or entering streams directly. But forests and wetlands slow this precipitation down, giving it time to soak into the ground instead of running into the nearest waterbody and swelling it to dangerous levels. Wetlands especially have the ability to store immense amounts of water, holding it during wet conditions and releasing it to ease drought conditions. Natural shorelines similarly slow runoff, using their deep root systems to reduce erosion and filter out contaminants before the water enters a lake or stream.

As forests and wetlands disappear and hardened surfaces like pavement, concrete or even compacted soils increase, total surface runoff flowing directly into streams increases. This can lead to increased flooding and erosion, and declining aquatic habitats.

The Ideal Conditions

Ideal conditions – and the implications for watershed health when they are not met – are primarily based on information contained in the *How Much Habitat*[2] *is Enough?* guideline[1] hereafter referred to as "HMHE" and/or the "Guideline." The Guideline offers clear suggestions (Table 3.1) as to how much woodland, wetland, riparian and other natural land covers are required to maintain these naturally functioning ecosystems and a healthy watershed.

Table 3.1 Summary of HMHE Wetland, Riparian and Forest Habitat Targets and Thresholds

Wetland Habitat	
Percent wetlands in the watershed and subwatersheds	Ensure no net loss of wetland area and focus on maintaining and restoring wetland functions at a watershed and subwatershed scale based on historic reference conditions. At a minimum, the greater of (a) 10% of each major watershed and 6% of each subwatershed, or (b) 40% of the historic watershed wetland coverage, should be protected and restored.
Riparian Habitat	
Percent of an urbanizing watershed that is impervious	Urbanizing watersheds should maintain less than 10% impervious land cover in order to preserve the abundance and biodiversity of aquatic species. Significant impairment in stream water quality and quantity is highly likely above 10% impervious land cover and can often begin before this threshold is reached. In urban systems that are already degraded, a second threshold is likely reached at the 25 to 30% level.
Percent of naturally vegetated stream length	75% of stream length should be naturally vegetated.
Width of natural vegetation adjacent to stream	Both sides of streams should have a minimum 30-metre-wide naturally vegetated riparian area to provide and protect aquatic habitat. The provision of highly functional wildlife habitat may require total vegetated riparian widths greater than 30 metres.
Forest Habitat	
Percent forest cover	30% forest cover at the watershed scale is the minimum forest cover threshold. This equates to a high-risk approach that may only support less than one half of the potential species richness, and marginally healthy aquatic systems; 40% forest cover at the watershed scale equates to a medium-risk approach that is likely to support more than one half of the potential species richness, and moderately healthy aquatic systems; 50% forest cover or more at the watershed scale equates to a low-risk approach that is likely to support most of the potential species, and healthy aquatic systems.
Area of largest forest patch	A watershed or other land unit should have at least one, and preferably several, 200-hectare forest patches (measured as forest area that is more than 100 metres from an edge).
Percent of watershed that has forest interior	The proportion of the watershed that is forest cover and 100 metres or further from the forest edge should be greater than 10%.

How do we measure it?

Land cover change in the Rideau River Watershed is monitored at a 1:4000 scale using 20 cm resolution DRAPE orthorectified imagery. DRAPE (Digital Raster Acquisition Project for the East) uses aircraft to capture 1km x 1km images under cloud free, snow free, ice free, smoke free, and leaf-off conditions. Imagery of the entire watershed was captured in the spring of 2008 and 2014, and through a combination of imagery captured in autumn of 2019 and spring of 2020.

This mapping helps to better understand how the landscape is changing, and has laid the data foundation for this report's wetland, woodland, riparian-shoreline and land cover statistics.

Woodlands and wetlands covered more than half of the total area of the watershed in 2020, followed by crop and pastureland and meadow-thicket.

LAND COVER CHANGE IN THE RIDEAU VALLEY

Woodlands and wetlands covered more than half (52.2%) of the total area of the watershed in 2020, followed by crop and pastureland (19.7%) and meadow-thicket (9.4%). Settlements (cities, towns, villages and hamlets) and transportation routes occupied another 13.2% of the Rideau River Watershed, followed by water (5.0%) and aggregate extraction operations (0.5%). Between 2008 and 2020, there has been an overall change of 179.45 square kilometres.

In total, there were 57 occurrences of the eight land cover classes (shown in Table 3.2) moving from one land cover class type to another. Over that time period, aggregate, transportation, settlement, water and woodland cover types have trended upward (i.e. increased in areal extent) while crop and pastureland, meadow-thicket, and wetland cover types have trended downward (i.e. decreased in areal extent). The largest net increases have occurred in the amount of new development (+34.4 km^2) and area of woodland (+20.3 km^2) with the largest losses occurring in the area of crop and pastureland (-40.0 km^2) and wetland (-15.3 km^2).

The majority of the change in the Rideau River Watershed is a result of the conversion of crop and pastureland to meadow-thicket (42.6 km^2), meadow-thicket to woodland (37.5 km^2) and crop and pastureland to settlement (17.0 km^2). Other notable change includes the conversion of meadow-thicket to crop and pastureland (10.6 km^2), meadow-thicket to settlement (9.2 km^2), wetland to crop and pastureland (8.4 km^2), woodland to settlement (8.2 km^2) and woodland to crop and pastureland (8.1 km^2).

Figure 3.1 displays land cover across the RVCA's jurisdiction in 2020 and Table 3.2 provides comparative statistics about the area and percentage of various land cover types in 2008 and 2020.

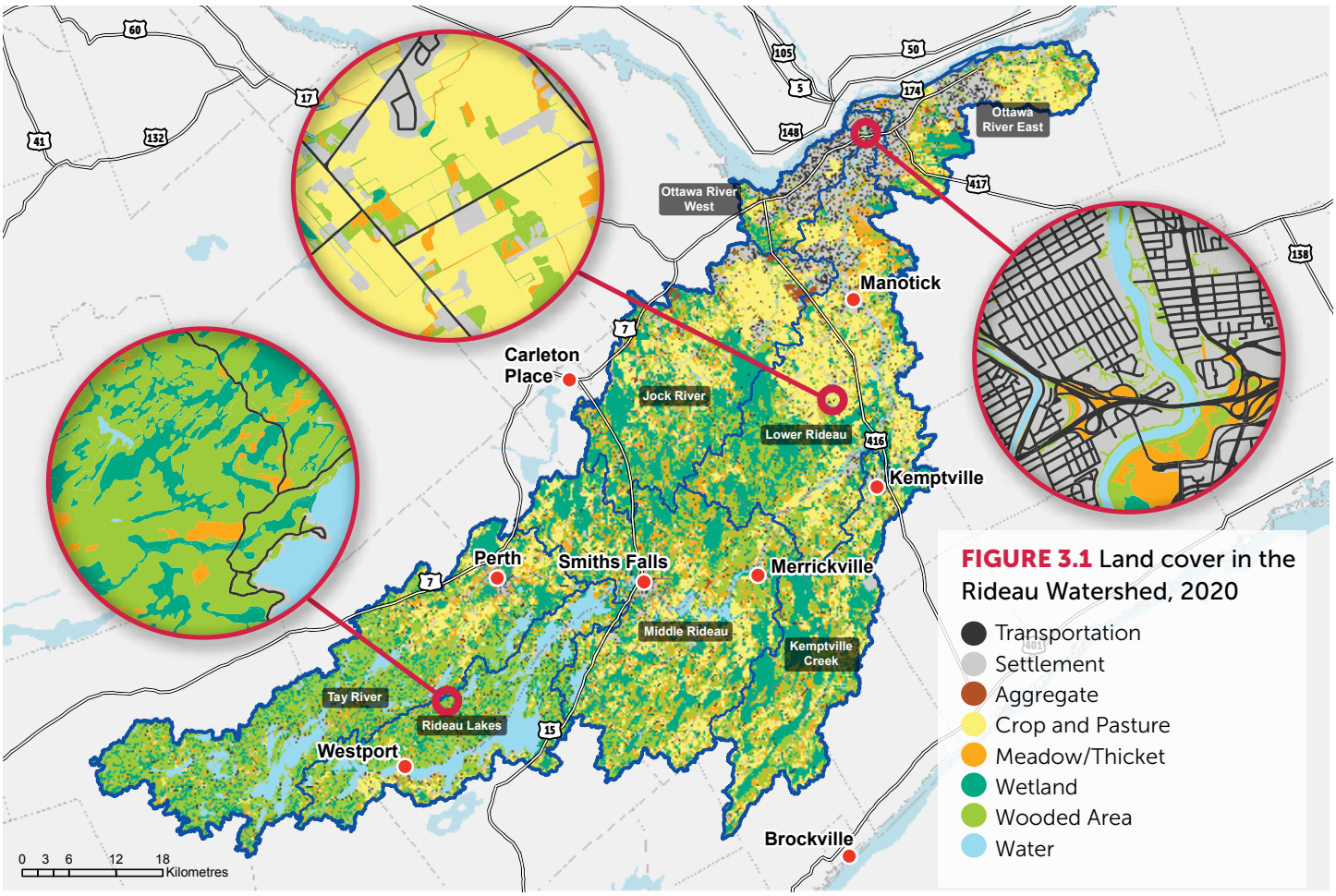


FIGURE 3.1 Land cover in the Rideau Watershed, 2020

Table 3.2 Rideau River Watershed: Land Cover

Land Cover in the Rideau River Watershed	2008		2020		2008 to 2020 Change		
	Area		Area		Area		
	km²	%	km²	%	km²	%	Trend
Woodland[1]	1201.56	28.31	1221.86	28.79	20.30[4]	1.69	↑
Wetland[2]	1010.21	23.81	994.96	23.45	-15.25	-1.51	↓
Crop and Pasture	876.17	20.65	836.22	19.71	-39.95	-4.56	↓
Meadow-Thicket	408.48	9.63	399.58	9.42	-8.90	-2.18	↓
Settlement[3]	342.99	8.08	377.35	8.89	34.36	10.02	↑
Water	208.76	4.92	210.00	4.95	1.24	0.59	↑
Transportation	177.03	4.17	184.23	4.34	7.20	4.07	↑
Aggregate	18.36	0.43	19.37	0.46	1.01	5.52	↑
Watershed Total	**4,243.57**	**100.00**	**4,243.57**	**100.00**	**----**	**----**	**----**

1. Does not include treed swamps 2. Includes treed swamps 3. Includes commercial, industrial, institutional and residential 4. Increase is mostly due to natural succession of meadow-thicket to young age-class woodland.

Land Cover Change in the Subwatersheds

Breaking down the changes shown in Table 3.2 by subwatershed, it is clear that some areas of the watershed have seen greater change between 2008 and 2020 than others, as shown in Table 3.3.

Table 3.3 RVCA Subwatersheds: Major Land Cover Conversions

Major Land Cover Change	Area of Change (km²)						
	Tay River	Rideau Lakes	Middle Rideau	Kemptville Creek	Jock River	Lower Rideau	Ottawa East
Crop and Pasture to Meadow-Thicket	9.4	2.3	8.0	4.0	6.4	9.0	3.2
Crop and Pasture to Settlement	----	----	2.5	----	6.8	3.2	----
Meadow-Thicket to Woodland	8.6		9.1	2.6	5.4	8.9	----
Meadow-Thicket to Crop and Pasture	----	----	2.1	----	----	3.7	----
Meadow-Thicket to Settlement	----	----	----	----	----	2.5	2.1
Wetland to Crop and Pasture	----	----	----	----	----	3.9	----
Wetland to Settlement	----	----	----	2.4	----	----	----
Woodland to Crop and Pasture	----	----	----	----	----	3.5	----
Woodland to Settlement	----	----	----	----	2.0	2.4	----

Notable thematic land cover changes (for the top 19 change scenarios representing 95% of total area change) include those for:

- **Crop and Pastureland (-39.4 km²)** with losses in the Jock River (-10.6 km²), Tay River (-9.5 km²), Middle Rideau River (-7.0 km²), Rideau Lakes (-4.1 km²), Ottawa River East (-3.3 km²), Lower Rideau River (-2.4 km²), Kemptville Creek (-2.2 km²) and Ottawa River West (-0.3 km²) subwatersheds.

- **Wetlands (-14.9 km²)** with losses in the Lower Rideau River (-5.0 km²), Kemptville Creek (-4.0 km²), Jock River (-3.2 km²), Middle Rideau River (-1.9 km²), Ottawa River East (-0.6 km²) and Tay River (-0.2 km²) subwatersheds.

- **Meadow-Thicket (-8.8 km²)** with losses in the Lower Rideau River (-4.8 km²), Middle Rideau River (-2.6 km²), Jock River (-1.6 km²), Tay River (-0.8 km²) and Ottawa River West (-0.6 km²) Subwatersheds and, gains in the Ottawa River East (+1.1 km²) and Rideau Lakes (+0.5 km²) subwatersheds.

- **Woodlands (+20.3 km²)** with gains in the Tay River (+8.2 km²), Middle Rideau River (+5.9 km²), Lower Rideau River (+2.5 km²), Kemptville Creek (+1.8 km²), Jock River (+1.3 km²), Rideau Lakes (+1.1 km²) and Ottawa River West (+0.8 km²) subwatersheds and, losses in the Ottawa River East Subwatershed (-1.3 km²).

Some major land cover/use trends conveyed by these summaries include:

- Ongoing abandonment of farmland throughout the RVCA's jurisdiction
- Continuing loss of wetland concentrated in the Lower Rideau System
- More woodlands through forest succession, primarily in the Upper/Middle Rideau Systems

Land Cover Imperviousness

Table 3.4 provides a breakdown of impervious land cover by subwatershed along with any change that has taken place between 2008 and 2020. The overall amount of impervious cover (i.e., hardened surface) has increased by 24 square kilometers in the Rideau River Watershed through this time period. Figure 3.2 provides a graphic presentation of the numbers presented in Table 3.4.

Table 3.4 RVCA Subwatersheds: Impervious Land Cover,* Change and Thresholds

Imperviousness in Rideau Subwatersheds	2008		2020		2008 to 2020 Change			2020 Thresholds		
	Area		Area		Area		Trend	Area		
	km²	Percent	km²	Percent	km²	Percent		<10%	10-25%	>25%
Tay River	16.2	2.0	16.9	2.1	0.7	4.2	↑	✓	---	---
Rideau Lakes	9.4	2.1	9.6	2.1	0.2	1.7	↑	✓	---	---
Middle Rideau	22.7	2.7	23.9	2.9	1.1	5.0	↑	✓	---	---
Kemptville Creek	12.0	2.7	12.7	2.8	0.6	5.2	↑	✓	---	---
Jock River	30.2	5.3	40.7	7.2	10.5	34.9	↑	✓	---	---
Lower Rideau	94.1	12.3	101.4	13.2	7.3	7.8	↑	---	✓	---
Ottawa East	56.3	50.3	56.5	50.4	0.2	0.3	↑	---	---	✓
Ottawa West	69.9	26.5	73.2	27.8	3.4	4.8	↑	---	---	✓
Total	310.8	7.3	334.8	7.9	24.0	7.7	↑	✓	---	---

*Aggregate, Settlement (commercial, industrial, institutional, residential), Transportation

In 2020, the Ottawa East Subwatershed had the highest percentage of impervious cover (50.4%) followed by the Ottawa West Subwatershed (27.8%), Lower Rideau Subwatershed (13.2%) and the Jock River Subwatershed (7.2%), all of which are located partially or wholly within the urban boundary of the City of Ottawa. The other subwatersheds (Tay River, Rideau Lakes, Kemptville Creek and Middle Rideau) have very small areas of impervious cover relative to their overall areas, ranging from 2.1% to 2.9%.

All subwatersheds have seen an increase in the area of impervious cover between 2008 and 2020. The majority of the change has taken place in the lower reaches of the Rideau Watershed within the Lower Rideau, Jock River and Ottawa West subwatersheds. This is to be expected, as they lie partially or completely within the urban area of the City of Ottawa which has experienced a considerable increase in land development (commercial, industrial, residential, institutional and related infrastructure) between 2008 and 2020. The Jock River Subwatershed has seen the greatest increase in impervious cover through this time period (10.5 km^2), followed by the Lower Rideau Subwatershed (7.3 km^2) and the Ottawa West Subwatershed (3.4 km^2). All other Rideau subwatersheds have experienced very small increases in impervious cover ranging between 0.2 km^2 and 1.1 km^2.

The majority of the change has taken place in the lower reaches of the Rideau Watershed within the Lower Rideau, Jock River and Ottawa West subwatersheds.

FIGURE 3.2 Impervious Cover in RVCA Subwatersheds

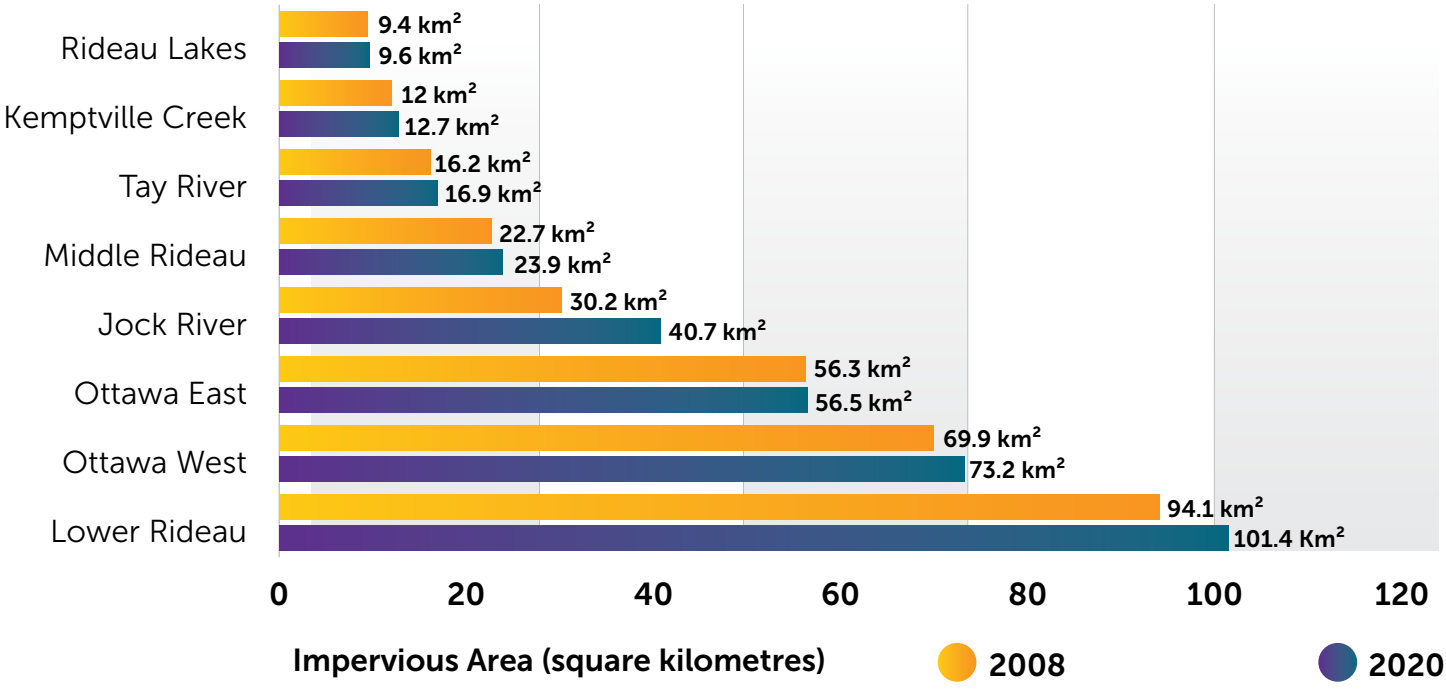
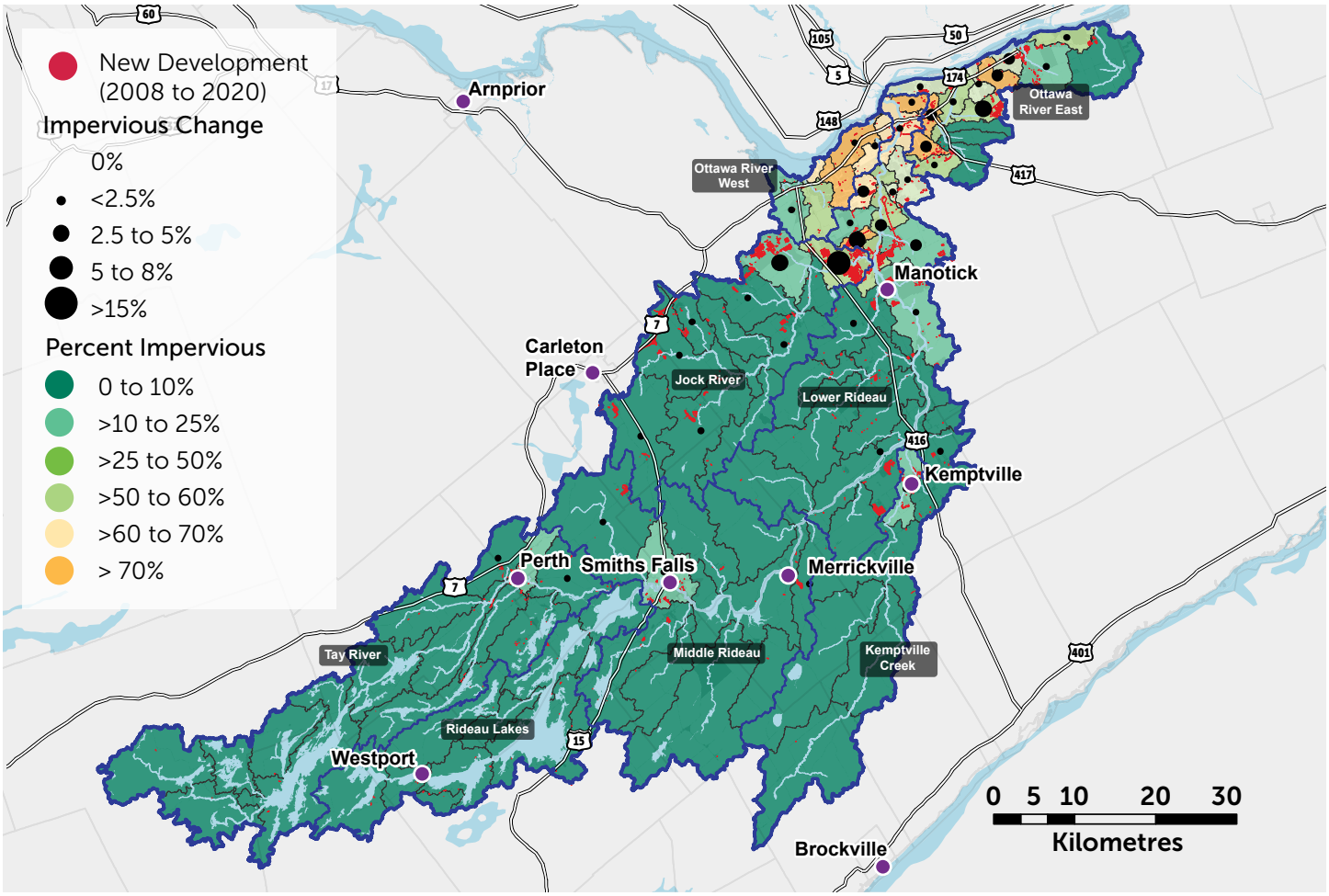


Figure 3.3 shows a range of impervious cover percentages across the Rideau River Watershed in 2020 by catchment along with a symbolic representation of the percentage change in impervious cover that has occurred between 2008 to 2020.

FIGURE 3.3 Impervious Cover in RVCA Catchments



IMPACTS AND IMPLICATIONS

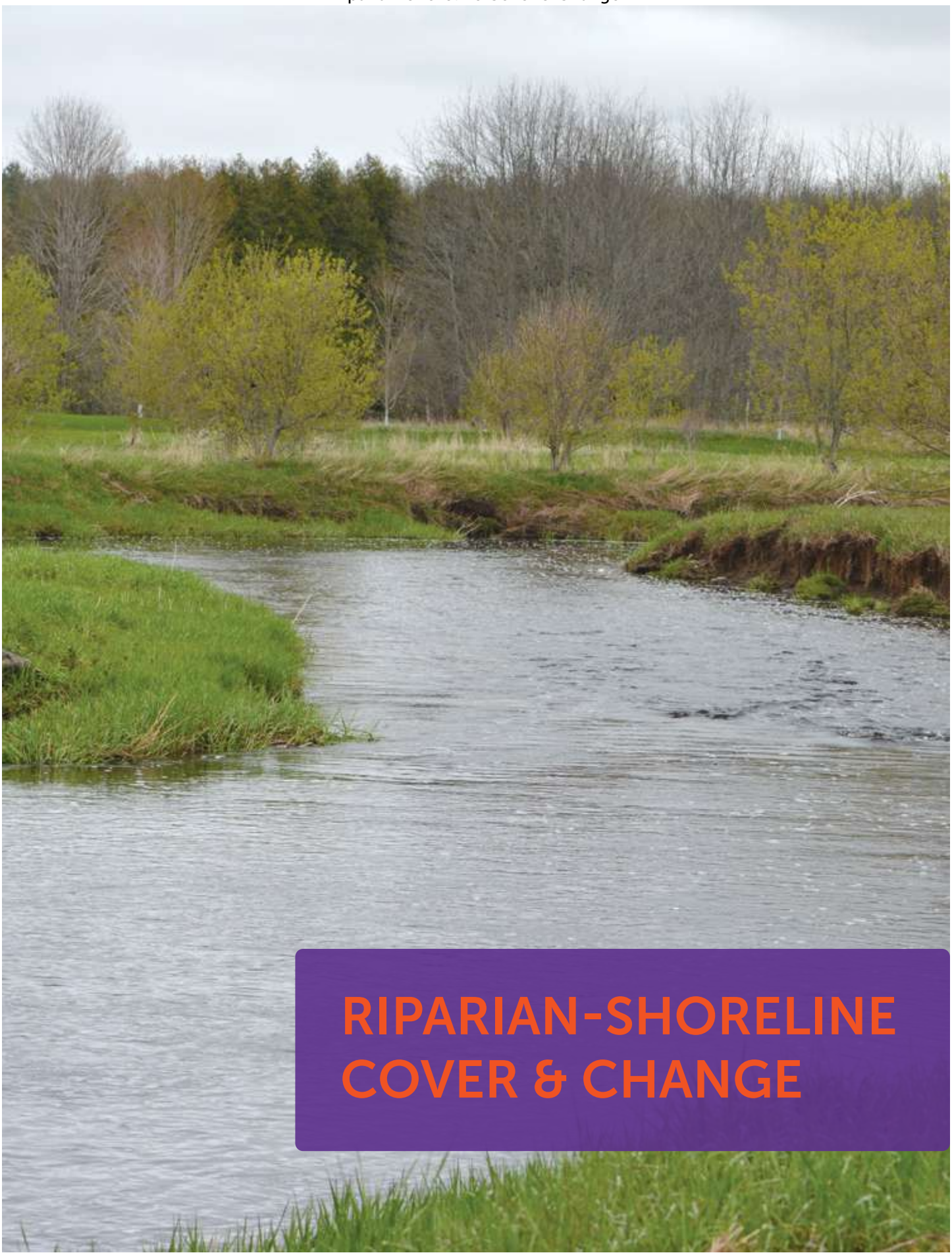
Increases in impervious cover between 2008 and 2020, particularly in the Jock and Lower Rideau subwatersheds, can negatively impact the health of aquatic and terrestrial ecosystems. While most subwatersheds still remain below the ideal impervious cover threshold of 10% noted in the *How Much Habitat is Enough?* Guideline, the most urbanized subwatersheds have already crossed that line, with several breaching the secondary 25% impervious land cover threshold.

The consequences of breaching these thresholds are especially concerning as they apply to aquatic/fish habitat and related water quality. These habitats are the direct recipients of stormwater runoff from hardened surfaces that can be polluted with organic and inorganic elements and metals, along with higher water flows that can increase erosion, sedimentation and higher water levels that can cause flooding.

Of course, in many urbanized areas, ecosystems have shifted to an entirely new, and often irreversible, ecological state where it is nearly impossible to restore to the level of the HMHE guidelines. Nonetheless, considerable effort continues to be made through programs like the RVCA's City Stream Watch Program to address these negative impacts along with the many other related water resources improvements being made by the City of Ottawa and other agencies working in the National Capital Region.

It is critical to note that the HMHE guidelines are intended as minimum ecological requirements and should not be used to set lower habitat targets for landscapes that currently have habitat in excess of the guideline minimums. Generally, a greater diversity and amount of habitat than the minimum will always be more beneficial in terms of supporting healthy species populations and a wider range of ecological services that watershed residents rely upon for their well-being, including the provision of drinking water, recreational activities and erosion and water flow regulation.

▲ The neighbourhood of Chapman Mills in the suburb of Barrhaven is built beside the Rideau River. Chapman Mills Conservation Area protects the floodplain from development.



RIPARIAN-SHORELINE COVER & CHANGE

The riparian zone is the area where terrestrial and aquatic systems meet along the shorelines of lakes and rivers, influencing each other and functioning as a complete ecosystem often called the "ribbon of life." Riparian habitat has attributes of both wetland and upland areas, and provides a critical transition between forest, stream and lake.

This critical habitat remains largely intact across much of the RVCA's jurisdiction, but has been heavily impacted in agricultural and urban areas. Nearly a quarter of the land area included in riparian zones across the watershed has been displaced by human activities such as farming, land development for housing and commercial purposes, road construction and aggregate extraction. In urban areas especially, large rivers do not meet the 75% target for riparian conditions, although the Rideau River Watershed at large meets the minimum recommended criteria for its lakes and streams.

Why is it important?

Riparian zones play an essential role for aquatic habitats, acting as both a buffer between aquatic ecosystems and terrestrial systems and as a contributor of resources including woody structures, nutrients and shade. Riparian areas are complex and species-rich systems, which provide core habitat areas for many amphibian and reptile species that spend their lives in both aquatic and terrestrial habitats and require riparian lands to complete their life cycles. Well-vegetated shorelines are also critically important in protecting shorelines from storm swells and erosion, and for maintaining water quality. Natural shorelines intercept sediments and contaminants that can degrade water quality conditions and harm lake and stream fish habitat.

They also improve habitat for fish by shading and cooling the water and provide protection for birds and other wildlife that feed and rear their young near water[3]. Vegetated riparian zones also serve as terrestrial habitat and corridors for wildlife as well as places where terrestrial and aquatic food webs interconnect.[2]

The Ideal Condition

According to the federal *How Much Habitat is Enough?* Guideline, streams and rivers should have at least 30 metres of natural riparian habitat on either side – although more is always better.

- Both sides of streams should have a minimum 30-metre-wide naturally vegetated riparian area to provide and protect aquatic habitat. The provision of highly functional wildlife habitat may require total vegetated riparian widths greater than 30 metres. This HMHE 30-metre riparian adjacent vegetation guideline is not based on a species or function specific need but reflects a general threshold distance for aquatic health and riparian functions and is meant to capture a variety of protection and habitat functions.[2]
- Seventy-five percent (75%) of stream length should be naturally vegetated. This HMHE guideline focuses on the cumulative effect of the riparian zone on stream habitat, and water quality as related to stream habitat.[2]

CURRENT CONDITIONS

Riparian-Shoreline Cover and Change

Within the 30-metre riparian zone of all lakes, river, streams and headwater tributaries in the Rideau River Watershed, 76% of the land was in some form of natural cover in 2020, comprised mainly of wetland (39%), woodland (28%) and meadow-thicket (9%). The remaining 24% of land in the watershed's riparian zones contained anthropogenic land cover types: crop and pastureland (13%), settlement (6%), transportation routes (4%) and aggregate extraction operations (<1%).

Between 2008 and 2020, aggregate, meadow-thicket, settlement, transportation and woodland cover types in the riparian zone have trended upward (i.e. increased in extent) while crop and pastureland and wetland cover types have trended downward (i.e. decreased in extent).

Most of the change has taken place within four cover types, with the greatest losses occurring in crop and pastureland (-220 hectares) and wetland (-179 hectares), and the largest gains in new development (+188 hectares) and woodland (+152 hectares). The net effect of all changes listed in Table 3.5 has been a decrease of 15 hectares in the total amount of natural riparian cover in the Rideau River Watershed.

Figure 3.4 shows a range of riparian-shoreline cover percentages across the RVCA's jurisdiction in 2020 by catchment, along with a symbolic representation of the amount of riparian-shoreline cover change that has occurred between 2008 to 2020. Table 3.5 provides statistics about the area and percentage of riparian-shoreline land cover types in the watershed within the 30 metre riparian zone adjacent to the shoreline of lakes, rivers, streams and headwater tributaries in 2008 and 2020.

FIGURE 3.4 Riparian-Shoreline cover in the Rideau River Watershed, 2020

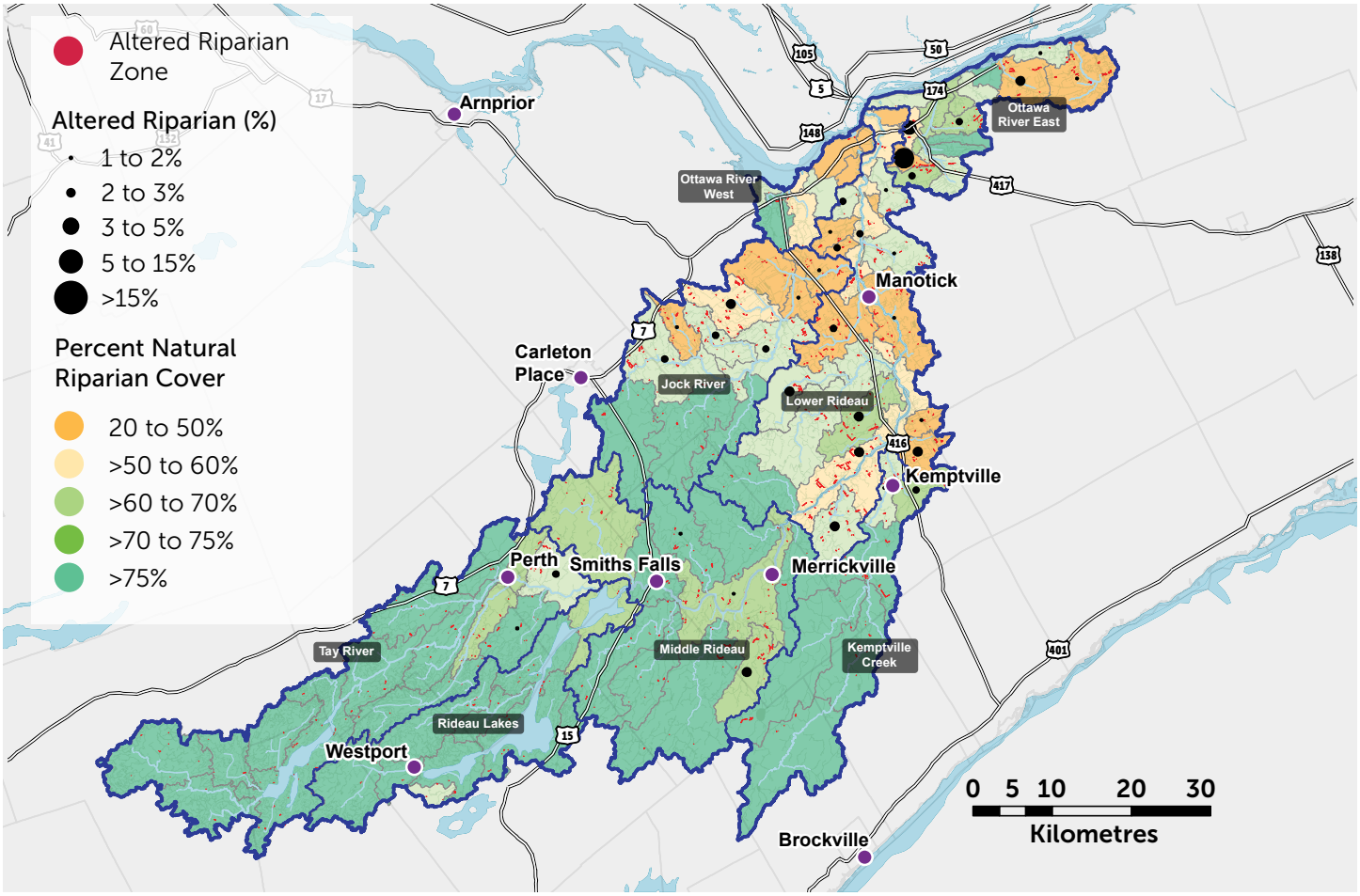


Table 3.5 Land Cover in 30 m Riparian-Shoreline Zone

Rideau Watershed: Riparian Land Cover	2008		2020		2008-2020		
	Area		Area		Change		
	Ha	Percent	Ha	Percent	Ha	Percent	Trend
Natural (total)	34478.71	76.31	34462.92	76.27	-15.79	-0.05	↓
Wetland **	17751.97	39.29	17578.01	38.90	-173.95	-0.98	↓
Woodland*	12477.48	27.61	12630.05	27.95	152.58	1.22	↑
Meadow-Thicket	4243.53	9.39	4254.86	9.42	11.33	0.27	↑
Water	5.74	0.01	0.00	0.00	-5.74	-100.00	↓
Other (total)	10706.02	23.69	10721.80	23.73	15.79	0.15	↑
Crop and Pasture	6284.27	13.91	6064.51	13.42	-219.76	-3.50	↓
Settlement	2441.51	5.40	2630.16	5.82	188.64	7.73	↑
Transportation	1848.22	4.09	1888.09	4.18	39.87	2.16	↑
Aggregate	132.01	0.29	139.05	0.31	7.03	5.33	↑
Totals	**45,184.73**	**100.00**	**45,184.73**	**100.00**	**0.00**	**0.00**	**0.00**

*Does not include treed swamps **Includes treed swamps

Riparian-Shoreline Cover and Change by Waterbody

Natural riparian cover ranges from a high of 92 percent along streams in the Rideau Lakes Subwatershed to a low of 47% around Otter Lake. The Rideau Canal – a man-made waterway – had only 25% natural cover in 2020 between Hogs Back and Parliament Hill.

The majority of the watershed's waterbodies have experienced less than a one percent change in natural riparian cover between 2008 and 2020; exceptions to this include Otter Lake (3.8% decrease), the Jock River (1.9% increase) and Lower Rideau streams (1.1% decrease).

It is worth noting that the reported decrease in Lower Rideau natural riparian cover confirms the trend stated in the *Lower Rideau Watershed Strategy*: "Continued loss of streamside and shoreline vegetation (trees and shrubs) that provide a natural buffering of the tributaries and reaches from adjacent land impacts." [4] All Rideau Lakes and Tay River waterbodies have more than the recommended 75% natural riparian cover, as does the Rideau River and its tributary streams in the Middle Rideau Subwatershed; this also applies to Kemptville Creek and its tributaries along with the main stem of the Jock River and the Ottawa River in the Ottawa East Subwatershed.

All other waterbodies had less than the 75% minimum in 2020. As for the Rideau Watershed at large, it meets the minimum recommended criteria for its lakes and streams, but not for its rivers.

Table 3.6 provides statistics about the area and percentage of natural land cover within the 30 metre riparian zone adjacent to the shoreline of lakes, rivers, streams and headwater tributaries along with any change that has taken place between 2008 and 2020.

It also shows those subwatersheds meeting or exceeding the recommended HMHE threshold of a minimum 30 metre wide naturally vegetated riparian area adjacent to a creek, stream, river and around a lake for at least 75 percent of its length in 2020.

Table 3.6 Natural Riparian-Shoreline Cover* in 30 m Zone by Waterbody Type

Natural Riparian-Shoreline Cover in Rideau Subwatersheds by Waterbody		2008		2020		2008 to 2020 Change			2020 Target
		Natural Area		Natural Area		Natural Area			Natural Area
		km²	Percent	km²	Percent	km²	Percent	Trend	≥75% shoreline
Tay River	Lakes	26.66	89.23%	26.68	89.30%	0.02	0.08%	↑	✓
	Streams	74.5	90.04%	74.83	90.43%	0.32	0.43%	↑	✓
	Tay River	2.55	83.71%	2.56	84.14%	0.01	0.51%	↑	✓
Rideau Lakes	Lakes	22.71	85.23%	22.66	85.03%	-0.05	-0.24%	↓	✓
	Streams	27.05	92.05%	27.1	92.21%	0.05	0.17%	↑	✓
Middle Rideau	Lake**	3.11	49.46%	2.99	47.56%	-0.12	-3.84%	↓	✗
	Streams	50.65	81.00%	50.61	80.95%	-0.03	-0.06%	↓	✓
	Rideau River	3.79	79.29%	3.79	79.31%	0	0.03%	↑	✓
Kemptville Creek	Streams	21.64	83.58%	21.55	83.21%	-0.09	-0.44%	↓	✓
	Kemptville Creek	2.57	86.11%	2.57	86.19%	0	0.10%	↑	✓
Jock River	Streams	30.56	62.81%	30.46	62.61%	-0.1	-0.32%	↓	✗
	Jock River	3.63	76.73%	3.71	78.26%	0.07	1.99%	↑	✓
Lower Rideau	Streams	44.19	60.31%	43.69	59.62%	-0.5	-1.13%	↓	✗
	Rideau River	3.21	54.06%	3.23	54.51%	0.03	0.85%	↑	✗

Table 3.6 Natural Riparian-Shoreline Cover* in 30 m Zone by Waterbody Type

Ottawa West	Streams	4.72	64.35%	4.76	64.87%	0.04	0.82%	↑	✗
	Rideau Canal	0.15	25.78%	0.15	25.78%	0	0.00%	↔	✗
	Ottawa River	0.46	52.77%	0.46	52.65%	0	-0.23%	↓	✗
Ottawa East	Lake***	0.28	53.90%	0.28	53.90%	0	0.00%	↔	✗
	Streams	18.02	58.68%	18.05	58.78%	0.03	0.16%	↑	✗
	Ottawa River	1.22	82.55%	1.21	81.77%	-0.01	-0.95%	↓	✓
Totals	Lake	55.86	83.50%	55.89	83.54%	0.03	0.05%	↑	✓
	Streams	271.34	75.26%	271.05	75.18%	-0.29	-0.11%	↓	✓
	Rivers	17.59	72.02%	17.69	72.44%	0.1	0.59%	↑	✗

*Meadow-Thicket, Wetland, Woodland **Otter Lake ***McKay Lake in Rockcliffe Park

▲ Altered riparian zones can have detrimental impacts on nearby aquatic habitats, while also increasing the risk of natural hazards such as flooding and erosion.

Figures 3.5, 3.6 and 3.7 provide a further graphical comparison of the natural riparian cover numbers presented in Table 3.6 by lake, stream and major waterway in percentage terms.

FIGURE 3.5 **Subwatershed Lakes: Natural Riparian Cover in 2008, 2020 and Change**

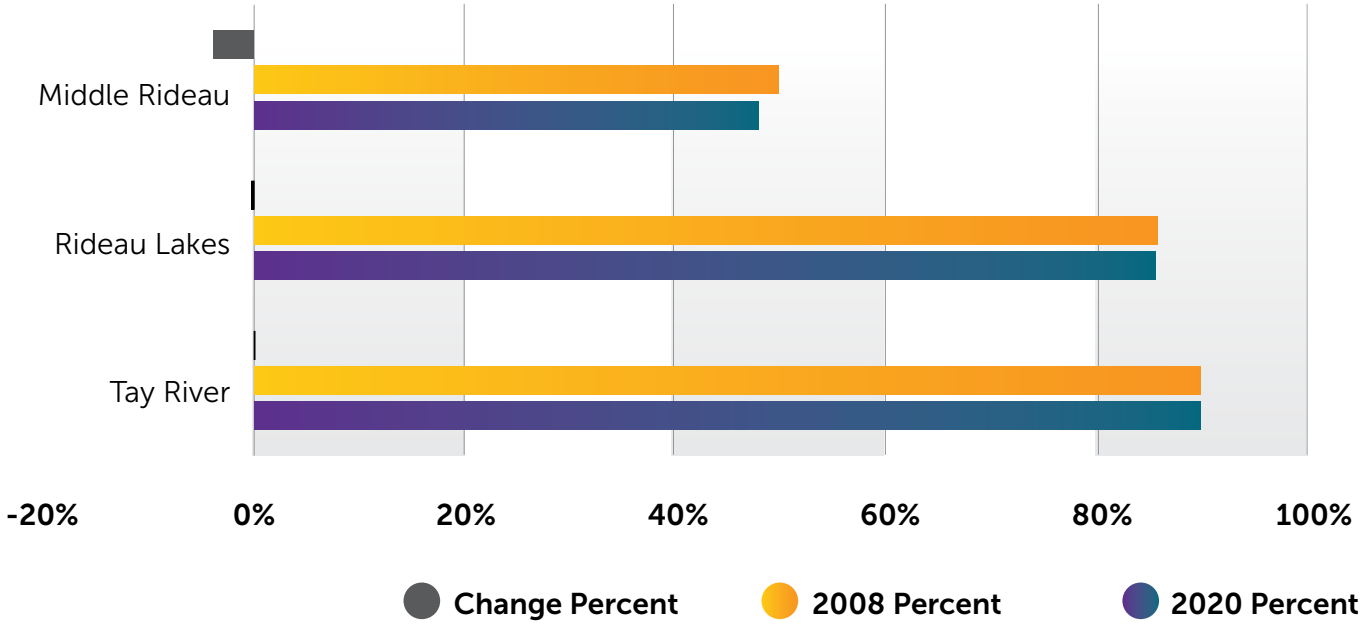


FIGURE 3.6 **Subwatershed Streams: Natural Riparian Cover in 2008, 2020 and Change**

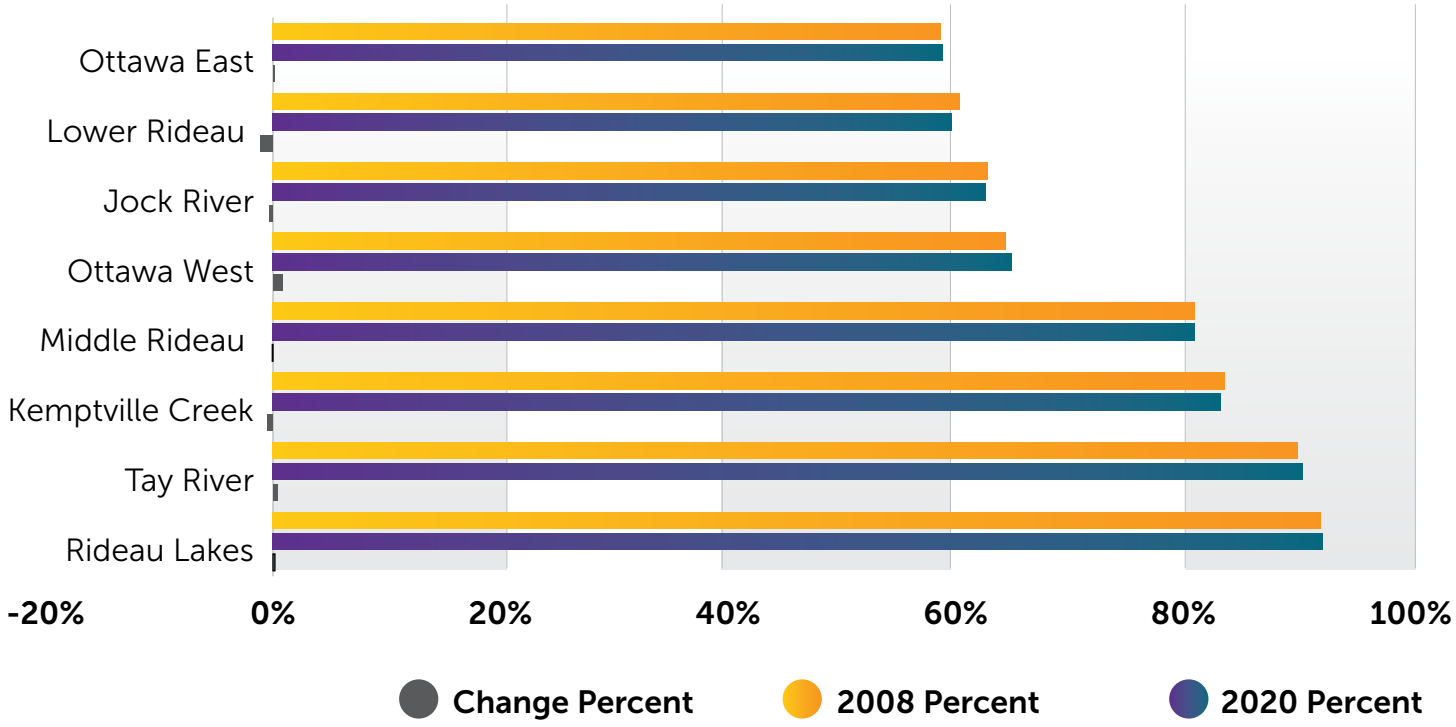
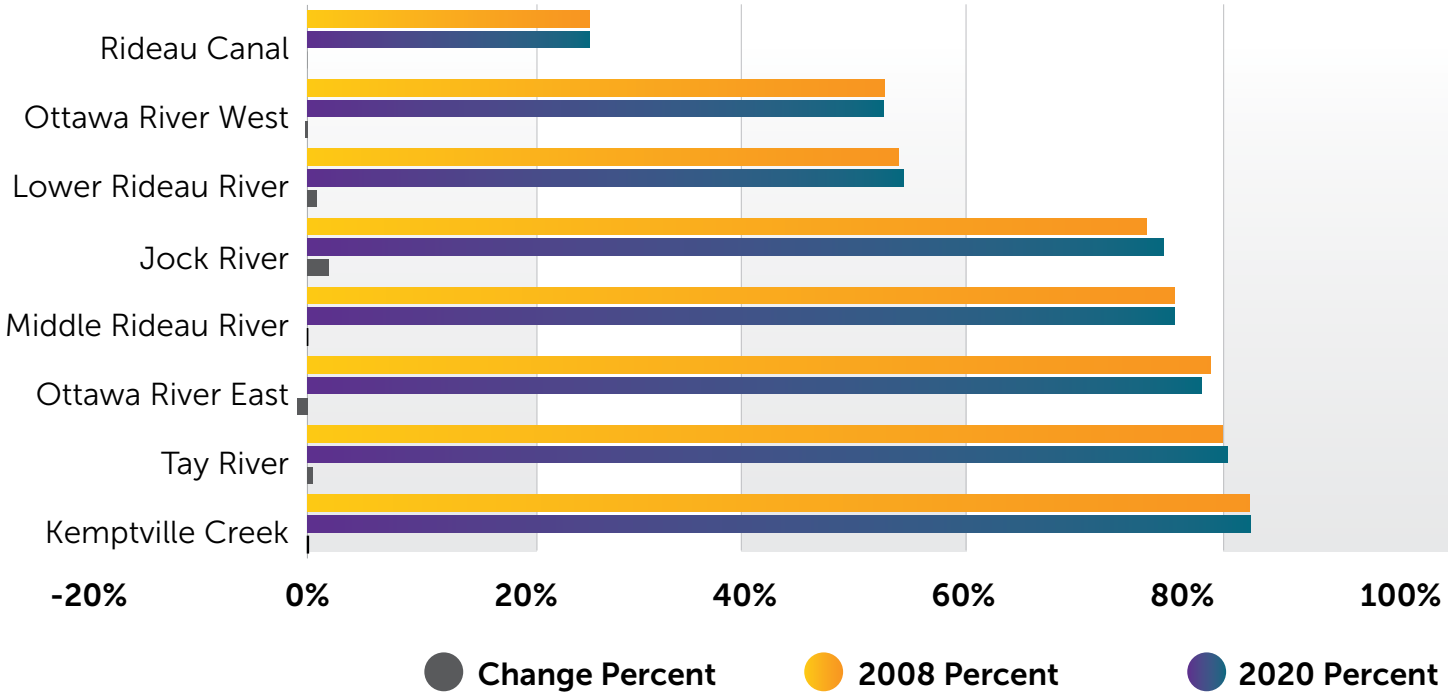


FIGURE 3.7 **Subwatershed Major Waterways: Natural Riparian Cover in 2008, 2020 and Change**



IMPACTS AND IMPLICATIONS

The mixed results for meeting the minimum thresholds for healthy riparian zones is a cause of concern; however, it can also point to opportunities for improving riparian zone conditions where they fall below the minimum.

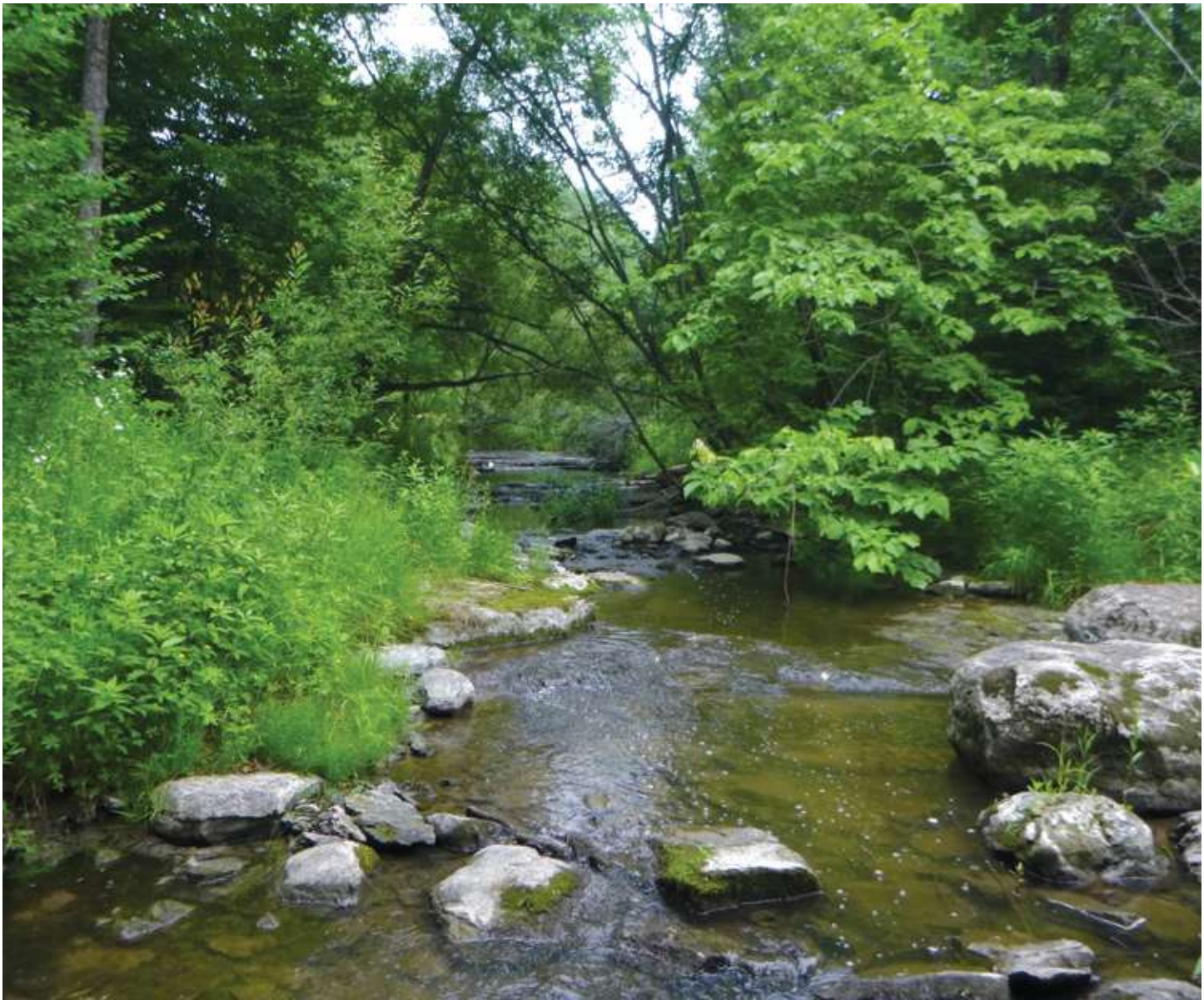
Riparian zones – particularly wider than the minimum 30 metres – can help mitigate the significant aquatic impacts that come with increasing impervious land cover across the broader watershed. Relatively narrow riparian zones may be adequate when the broader area is in good condition (i.e. dense, native vegetation on undisturbed soils), and the adjacent land use has low to medium impact potential (i.e. parkland or low density residential).

But wider riparian zones may be required to provide sufficient habitat and/or buffering functions for biologically sensitive systems, where the area is in poor condition, where soils are less permeable or highly erodible and slopes are steep, or where the adjacent land use is intense (e.g. intensive row-crop agriculture or urban centres). Measures of water quality and of fish communities provide feedback on the effectiveness of the riparian zone – in conjunction with the surrounding watershed land cover – in protecting and maintaining the aquatic environment.

Fish communities may be affected by direct influences on aquatic habitat such as point source and upstream inputs, or by other in-stream disturbances (human-induced or otherwise), or both. Furthermore, under current climate change predictions of increased extreme weather events, the disturbance regulation capacity of lands adjacent to surface water is of high importance.[5]

RVCA monitors and reports on aquatic habitat and water quality as well as classifying land cover, which is the basis for the numbers presented above. Additional analysis of these three metrics will need to be completed in order to identify those areas which do not meet the minimum 75% riparian buffer guideline and therefore require remedial work, as well as identifying areas that do meet the guideline to better target stewardship activities and other riparian improvement works.

More details on aquatic and surface water quality in the Rideau River Watershed can be found in Watershed Conditions Part 2: Water.



WETLAND COVER & CHANGE

Wetlands include all manner of marshes, bogs, swamps, fens and lands where the water table is close to the surface, and are among the most productive and biologically diverse habitats on the planet. As much as 70% of Ontario's wildlife inhabit wetlands during part or all of their life cycle, including many species at risk. Wetlands are known to support a wider range of flora and fauna than either temperate upland forests or grasslands, particularly on a species-per-area basis. But wetlands in our watershed are under threat. Since widespread colonial settlement began in the region about 200 years ago, the watershed has lost about 33% of its total wetland cover. But the most developed areas – notably subwatersheds within the urban areas of the City of Ottawa – have lost as much as 73% of their historic wetlands, with all four subwatersheds within Ottawa's boundaries having lost 40% or more.

The rate of loss has slowed, but it is still ongoing: the watershed lost a net 1.5% in wetland cover between 2008 and 2020. Only the Tay River Subwatershed saw a net increase between those years – and it was a mere 0.1%. Rideau Lakes Subwatershed saw no change, while the rest had decreases ranging from 0.7% to 3.2%.

▲ Mill Pond Conservation Area in Lombardy, Ontario, in the Upper Watershed of the Rideau Valley.

Why is it important?

Wetlands are required to preserve ecological processes and functions that secure and protect the quality of the biosphere in which humans and other organisms together must dwell. Wetlands provide a host of ecological goods and services, including:

- Mitigation of surface water flow by storing water during spring snowmelt and heavy rainfall events and releasing water during periods of low flow, which also reduces flood damage, as confirmed in a recent study [6];
- A stable, long-term water supply through groundwater recharge and discharge;
- Stabilization of shorelines and reduction of erosion damage through the mitigation of water flow and soil binding by plant roots;
- Improved water quality through the trapping of sediments, the removal and/or retention of excess nutrients, the immobilization and/or degradation of contaminants and the removal of bacteria;
- Acting as "carbon sinks" making a significant contribution to carbon storage;

Wetlands are required to preserve ecological processes and functions that secure and protect the quality of the biosphere in which humans and other organisms together must dwell.

- Sustainable harvesting of timber, fuel wood, fish, wildlife and wild rice;
- Opportunities for recreation, education, research and tourism;
- A high biological diversity of essential foraging, breeding and overwintering habitats that support a wide variety of plants and animals (including endangered or threatened species);
- Providing ecological linkage corridors for the movement of species between terrestrial and aquatic habitats and the movement of species along streams and rivers, and
- Significant wildlife habitat and/or fish habitat.

CURRENT CONDITIONS

Wetland Cover Changes between 2008 and 2020

In 2020, the Kemptville Creek, Jock River and Middle Rideau subwatersheds had the highest percentage of wetland in the Rideau River Watershed at 34.5%, 29.5% and 28.9% respectively, followed by the Tay River (20.3%), Lower Rideau (19.8%) and Rideau Lakes (17.1%) subwatersheds. Ottawa East and Ottawa West subwatersheds had the lowest percentage of wetland at 11.4% and 9.0% respectively. When all subwatershed wetlands are combined, they cover 995 km^2 (23.4%) of the RVCA jurisdiction; 46.5% of these are designated as provincially significant wetlands, another 1.1% are considered locally significant and the remaining 52.4% have not been evaluated.

Between 2008 and 2020, there has been an overall loss of 15.3 km^2 of wetland (including 1.7 km^2 of provincially significant wetland) which is broken down in detail in Table 3.7. Almost all subwatersheds have trended downward through that period, with the exception of Rideau Lakes and Tay River. The Lower Rideau Subwatershed has experienced the largest wetland loss (-5.1 km^2), closely followed by Kemptville Creek (-4.1 km^2) and Jock River (-4.0 km^2).

Smaller losses of wetland have occurred in the Middle Rideau (-1.6 km^2), Ottawa River East (-0.6 km^2) and Ottawa River West (-0.1 km^2) subwatersheds. Rideau Lakes exhibited no trend between 2008 and 2020, with the Tay River being the only subwatershed in the Rideau Valley to trend upward with a small increase of 0.2 km^2. These wetland losses can be largely attributed to agricultural, commercial, industrial and residential land use conversions.

Figure 3.8 shows a range of wetland cover percentages across the watershed in 2020 by catchment along with a symbolic representation of the amount of wetland area change that has occurred between 2008 to 2020. Table 3.7 provides statistics about the area and percentage of wetland in 2008 and 2020 by subwatershed.

The Ideal Condition

Following Environment Canada's *How Much Habitat Is Enough?* Guideline, watersheds should ideally retain the greater of either 40% of the historic watershed wetland cover, or 10% of the watershed's total land cover at a minimum. The caveat is that it is far more efficient and effective to protect existing habitats than to attempt to restore them.

Ensure no net loss of wetland area and focus on maintaining and restoring wetland functions at a watershed and subwatershed scale based on historic reference conditions. At a minimum, the greater of (a) 10% of each major watershed and 6% of each subwatershed, or (b) 40% of the historic watershed wetland coverage should be protected and restored.

This HMHE Guideline for wetland should be a starting point and not used to set lower habitat targets for landscapes that currently have wetland cover in excess of the guideline minimums, as often irreversible ecological damage will occur. Removing or degrading habitat, for example moving from 50% to 30% wetland cover (including treed swamps) will result in reduced wildlife populations, reduced capacity to provide ecological goods and services (including water storage) and lower ecological integrity.

FIGURE 3.8 Wetland cover in the Rideau River Watershed, 2020

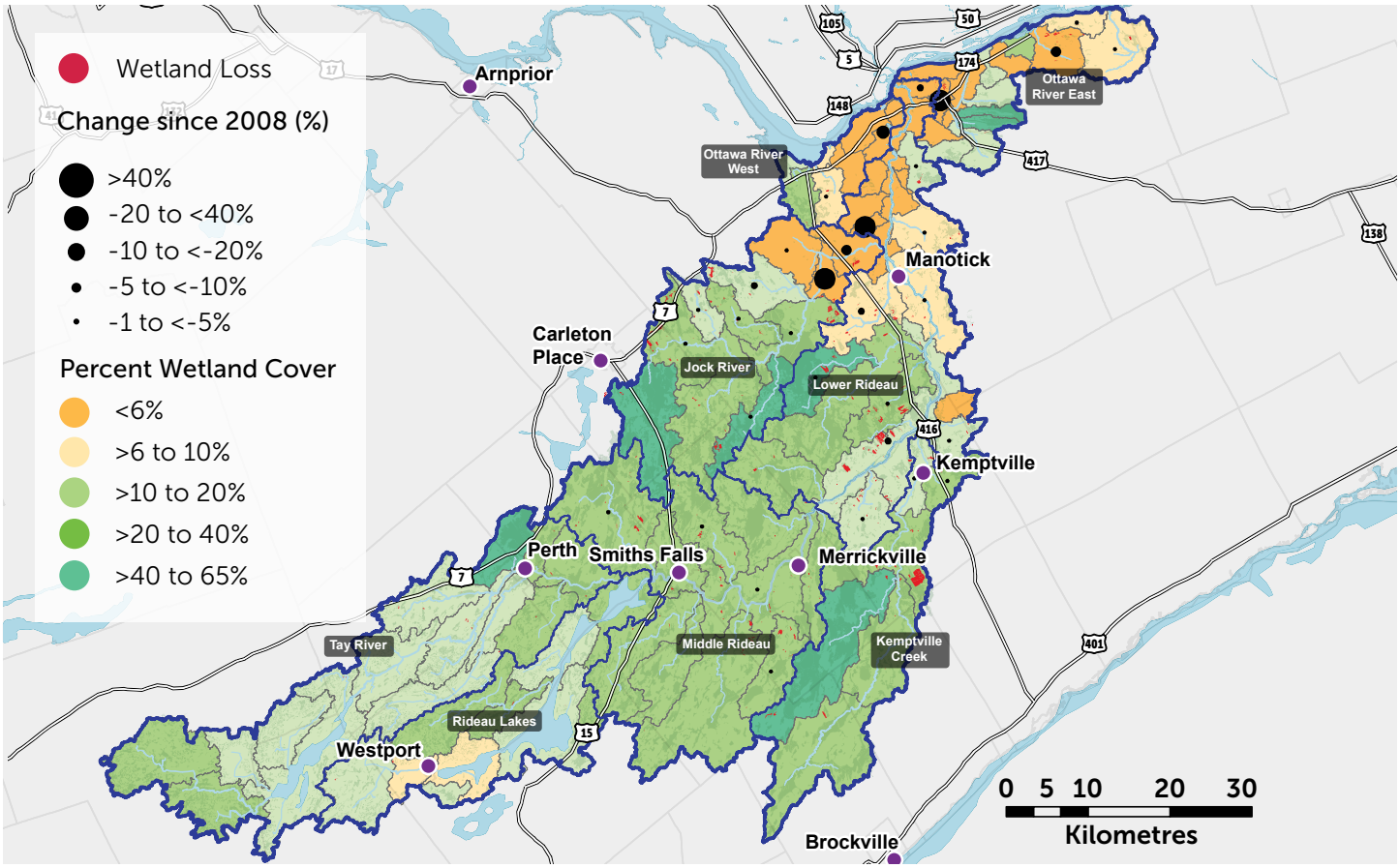


Table 3.7 Subwatersheds: Wetland Cover*

Wetland Cover in Rideau Subwatersheds	Pre-settlement**		2008		2020		Presettlement to 2020		2008 to 2020		
	Area		Area		Area		Change		Change		
	km²	%	km²	%	km²	%	km²	%	km²	%	Trend
Tay River	183.39	22.94	161.76	20.24	161.93	20.26	-21.46	-11.70	0.18	0.11	↑
Rideau Lakes	72.68	15.99	77.70	17.10	77.74	17.11	5.06	6.97	0.04	0.05	↑
Middle Rideau	268.15	32.46	240.64	29.13	238.99	28.93	-29.16	-10.87	-1.65	-0.68	↓
Kemptville Creek	172.12	37.94	160.68	35.42	156.62	34.52	-15.50	-9.00	-4.05	-2.52	↓
Jock River	288.08	50.73	171.70	30.24	167.70	29.53	-120.38	-41.79	-4.00	-2.33	↓
Lower Rideau	359.68	46.93	156.87	20.47	151.78	19.80	-207.90	-57.80	-5.09	-3.25	↓
Ottawa West	19.02	16.98	10.19	9.10	10.12	9.04	-8.90	-46.78	-0.07	-0.72	↓
Ottawa East	111.24	42.18	30.67	11.63	30.07	11.40	-81.18	-72.97	-0.60	-1.95	↓
Watershed Total	1,474.36	34.74	1,010.21	23.81	994.96	23.45	-479.40	-32.52	-15.25	-1.51	↓

*Includes treed swamps **Data for Canadian Shield areas of the Rideau Lakes and Tay River Subwatersheds is not as reliable as that for Off-Shield areas.

Pre-Settlement Wetland Cover

Prior to European settlement of Eastern Ontario, the Rideau River Watershed was bestowed with large areas of wetland cover. At that time, it is estimated that approximately 51% of the Jock River Subwatershed, 47% of the Lower Rideau Subwatershed, 42% of the Ottawa East Subwatershed, 38% of the Kemptville Creek Subwatershed, 32% of the Middle Rideau Subwatershed, 23% of the Tay River Subwatershed, 17% of the Ottawa West Subwatershed and 16% of the Rideau Lakes Subwatershed were covered in wetland.

Most subwatersheds have seen considerable change in wetland coverage since then. The largest percentage losses of wetland have occurred in the Ottawa East Subwatershed (-73%), Lower Rideau Subwatershed (-58%), Ottawa West Subwatershed (-47%) and Jock River Subwatershed (-42%). Substantially less wetland has been lost in the Tay River (-12%), Middle Rideau (-11%) and Kemptville Creek (-9%) subwatersheds. The only exception to this overall downward trend is in the Rideau Lakes Subwatershed, where data shows an estimated 7% increase in wetland cover (+5.1 km2) from pre-settlement times to the present.

The largest declines in the physical area of wetland lost since European settlement is estimated to have occurred primarily in three subwatersheds: the Lower Rideau (-208 km^2), Jock River (-120 km^2) and Ottawa East (-81 km^2). Somewhat lesser losses have been reported in the Middle Rideau (-29.2 km^2), Tay River (-21.5 km^2), Kemptville Creek (-15.5 km^2) and Ottawa West (-8.9 km^2) subwatersheds.

It is to be noted that estimates of pre-settlement wetland cover in the Rideau Lakes and Tay River subwatersheds are generally less reliable for those areas that are on the Canadian Shield. This is due to the methodology developed for modelling of presettlement wetlands that omitted "On-Shield" wetlands smaller than 10 hectares in size, which may help to explain the increase in wetland cover reported for the Rideau Lakes Subwatershed since colonization.

Adjacent Lands

The amount of natural habitat that is located adjacent to wetlands is critically important to the maintenance of wetland functions and attributes, particularly for wetland-dependent species like amphibians, turtles and waterfowl.

These adjacent wetland areas are described as Critical Function Zones (CFZs) in the HMHE Guideline, as they provide a variety of habitat functions for wetland-associated species that extend beyond the wetland limit, including foraging areas for frogs, and dragonflies, or nesting habitat for birds that straddle the wetland-upland ecozone. They are a functional extension of the wetland into the upland, and are an essential part of the wetland that reaches underground.

Adjacent lands are also critically important for protecting the hydrologic functioning of wetlands, including for groundwater recharge and discharge, and the overall water balance of the Rideau Valley. That is because these areas have significant soil storage which hold a lot of water just below the ground surface and, consequentially, high groundwater tables. When maintained in a natural state, as with the wetland itself, they emit significant quantities of water back into the air, keeping it off the land and out of flood prone areas alongside lakes, streams and rivers.

Natural Cover and Change within Adjacent Lands

Table 3.8 provides a breakdown of the area and percentage of natural land cover within the 30-metre adjacent lands to wetlands by subwatershed along with any change that has taken place between 2008 and 2020. This number is commonly cited and used for the protection of surface waters and wildlife functions occurring on the upland side of a wetland, including that for municipal land-use planning and development activity along with Conservation Authority wetland regulation permitting.

▲ Wetlands cover almost 1,000 km^2 within the watershed, but they are decreasing.

Natural cover within 30 metres of wetlands in 2020 ranges from a high of 94 percent in the Tay River Subwatershed to a low of 76 percent in the Ottawa East Subwatershed. Trending results are mixed with three subwatersheds moving upward, three downward and two showing almost no perceivable change between 2008 and 2020. The majority of subwatersheds have experienced little to no change in natural cover within the wetland adjacent lands; the exceptions being the Lower Rideau, the Jock River and Kemptville Creek that saw decreases of 2.4% (-93.8 ha.), 1.7% (-56.8 ha.) and 1.3% (-31.8 ha.) respectively.

Table 3.8 Subwatersheds: Natural Cover* within 30 m. of a Wetland

Natural Cover within the 30 m. Wetland Adjacent Zone by Subwatershed	2008		2020		2008 to 2020		
	Area				Change		
	Ha	Percent	Ha	Percent	Ha	Percent	Trend
Tay River	10918.26	93.28	10955.32	93.59	37.06	0.34	↑
Rideau Lakes	5242.36	92.83	5248.55	92.94	6.18	0.12	↑
Middle Rideau	5602.49	81.60	5603.01	81.61	0.52	0.01	←→
Kemptville Creek	2486.99	78.42	2455.19	77.42	-31.80	-1.28	↓
Jock River	3418.28	81.14	3361.48	79.80	-56.80	-1.66	↓
Lower Rideau	3991.48	80.77	3897.66	78.87	-93.82	-2.35	↓
Ottawa River West	391.16	82.13	392.22	82.35	1.06	0.27	↑
Ottawa River East	901.16	75.57	901.37	75.58	0.21	0.02	←→
Watershed Total	**32,952.19**	**86.23**	**32,814.80**	**85.87**	**-137.38**	**-0.42**	↓

*Meadow-Thicket, Wetland, Woodland

Wetland Cover Targets

Table 3.9 provides a summary of targets for presettlement and current wetland cover by subwatershed in 2020. All Rideau Valley subwatersheds meet the six percent wetland cover target recommended in the HMHE Guideline, and the watershed at large meets the minimum 10 percent wetland cover target. Similarly, all subwatersheds except Ottawa East meet the minimum 40 percent pre-settlement wetland cover target.

The HMHE Guideline makes it very clear that the six percent wetland target is a starting point for restoration targeting efforts, and should not be used to set lower habitat targets for landscapes that currently exceed the Guideline minimums. Otherwise, irreversible ecological damage would occur. Going forward, the goal should be to employ a "no-net loss of wetland" strategy for all remaining wetlands, and to focus restoration efforts on naturalizing the 30-metre adjacent lands around wetlands. HMHE also suggests that efforts at increasing wetland cover should be focused on restoring wetland functions at a watershed and subwatershed scale in those areas estimated to be below historic reference conditions, as is the case in the Ottawa East Subwatershed.

Table 3.9 Subwatersheds: Wetland Statistics and Targets

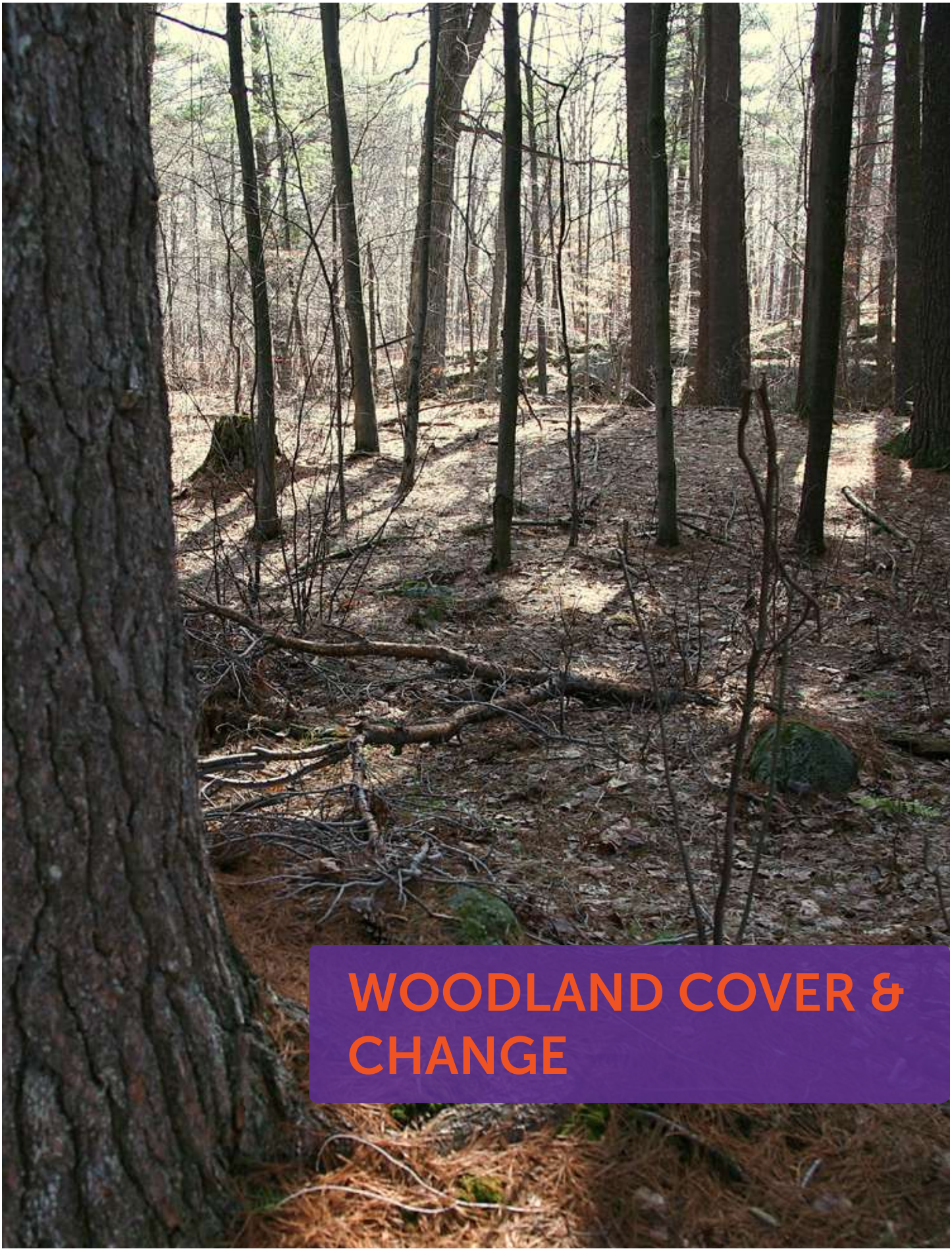
Wetland Statistics and Targets in RVCA Subwatersheds	2020				
	Total Wetland Area in Subwatershed	Targets			
		40% of Presettlement Wetland Area in Subwatershed		6% of Subwatershed Area in Wetland	
	km²	km²	Meets	km²	Meets
Tay River	161.93	73.36	✓	47.96	✓
Rideau Lakes	77.74	29.07	✓	27.26	✓
Middle Rideau	238.99	107.26	✓	49.57	✓
Kemptville Creek	156.62	68.85	✓	27.22	✓
Jock River	167.7	115.23	✓	34.07	✓
Lower Rideau	151.78	143.87	✓	45.99	✓
Ottawa West	10.12	7.61	✓	6.72	✓
Ottawa East	30.07	44.5	✗	15.82	✓
Watershed Total	**994.96**	**589.74**	✓	**254.61**	✓

IMPACTS AND IMPLICATIONS

The loss of 15.3 square kilometres of wetland (including 1.7 km² of provincially significant wetland) in the Rideau Watershed between 2008 and 2020 is a cause of major concern, as are the historic wetland losses estimated to be in the order of 479 square kilometres. These losses have severe implications for those municipalities and agencies responsible for protecting and managing the watershed's wetlands - as well as for private landowners - given the important role wetlands play in the hydrologic cycle and their critical contribution to sustaining the overall water balance of the Rideau Valley Watershed, all of which are now under an ever increasing threat from the effects of global warming.

Furthermore, the consequences of having less than 100% coverage of natural features within the 30 m. adjacent lands to the Rideau River Watershed's wetlands is well documented. In the long term, sustained water supplies and effective flood reduction will depend, in large part, on protecting the remaining wetland features throughout the watershed and restoring them in those areas of the Rideau River Watershed that are more prone to the impacts of a rapidly changing climate (e.g. degraded water quality conditions, low water levels negatively affecting aquatic organisms and biodiversity, stressed water supplies and increased flooding and erosion damage).

Together, these wetland losses and adjacent lands deficiencies require collective action to halt and increase wetland and adjacent lands natural cover going forward.



WOODLAND COVER & CHANGE

Woodlands are treed areas, woodlots or forested areas that provide excellent environmental and economic benefits to both the private landowner and the general public.

A few centuries ago, Eastern North America including the Rideau River Watershed was almost entirely covered by coniferous and deciduous forests. But by 1861, 17 townships in Eastern Ontario had already declined to less than 30 percent forest cover, with three having less than 10%. Forest cover continued to decline over the following twenty years, and by 1880 there were 32 townships with less than 30% cover and eight townships with less than 10% cover,[7] some of which are located in the Rideau River Watershed. The loss continues today, with a general downward trend in forest cover across the watershed. Critically, these losses are affecting large woodland patches rather than small ones, which in turn leads to a greater loss of interior forest habitat that is necessary to support a full range of native forest species.

These losses have many negative consequences, including habitat loss, accelerated climate change, shortages of fuelwood, loss of soil fertility, snow drifts blocking roads, severe spring floods, reduced summer stream flow and even reduction in the distribution and amount of rainfall.

Why is it important?

Forests are important parts of a healthy watershed because of their critical role in the hydrological cycle. Runoff after rain or snowmelt from an area of forested land is significantly less in both its volume and peak flow rate than runoff from a similar area that has been cleared or urbanized. Trees make subwatersheds more resilient to climate change's heavy rainfall, irregular storms and unseasonal precipitation. Forests clean the air, sequester and store carbon and reduce erosion along riparian areas, along with the provision of many other ecological goods and services that are essential not only for wildlife but for human well-being.

Forests also provide a great many habitat niches occupied by a great diversity of plant and animal species. They provide food, water and shelter for these species, whether they are breeding and living locally or using forest cover to help them move across the landscape. From a wildlife perspective, there is increasing evidence that the total forest cover in a given area is a major predictor of the persistence and size of bird populations, and it is likely that this pattern extends to other plant and animal groups. The overall pattern of distribution of forest cover, the shape, area and juxtaposition of remaining forest patches and the quality of forest cover also play major roles in determining how valuable forests will be to wildlife and people alike.[8]

The Ideal Condition

Environment Canada's *How Much Habitat Is Enough?* Guideline states a healthy watershed requires a minimum 30% forest cover to continue seeing the ecological and green infrastructure benefits that forests provide – but biodiversity and water quality will still suffer.

- 30% forest cover at the watershed scale is the minimum forest cover threshold. This equates to a high-risk approach that may only support less than one half of the potential species richness, and marginally healthy aquatic systems.
- 40% forest cover at the watershed scale equates to a medium-risk approach that is likely to support more than one half of the potential species richness, and moderately healthy aquatic systems
- 50% forest cover or more at the watershed scale equates to a low-risk approach that is likely to support most of the potential species, and healthy aquatic systems. This HMHE Guideline for woodland should be a starting point and not used to set lower habitat targets for landscapes that currently have habitat in excess of the guideline minimums, as often irreversible ecological damage will occur. Removing or degrading habitat, for example moving from 50% to 30% forest cover (including treed swamps) will result in reduced wildlife populations, reduced capacity to provide ecological goods and services and lower ecological integrity.

CURRENT CONDITIONS

Woodland Cover and Change

As of 2020, the Tay River and Rideau Lakes Subwatersheds had the highest percentages of woodland cover at 46.8% and 41.8% respectively, followed by the Kemptville Creek Subwatershed (34.3%) and Middle Rideau Subwatershed (31.9%). All other subwatersheds have less than the 30% woodland cover that is commonly cited as a minimum target for woodland protection and restoration: the Jock River (28.1%), Lower Rideau (27.0%), Ottawa East (21.6%) and Ottawa West (17.3%). When all subwatershed woodland cover is combined, the overall watershed average is 33.6%, which meets the minimum watershed-wide target.

When all subwatershed woodland cover is combined, the Rideau Watershed average is 33.6%, which meets the minimum watershed-wide target.

General woodland cover went up between 2008 and 2020, largely due to forest succession and tree planting efforts. But this increase belies the more damaging overall loss of 22.3 km^2 of "true" woodland (i.e. ≥ 60% woodland cover and ≥ 2m. in height), which is ecologically and hydrologically more valuable – and harder to replace when it disappears as a large swath. All RVCA subwatersheds trended downward in this category through that period, with the Lower Rideau (-8.6 km^2), Jock River (-5.6 km^2) and Middle Rideau (-3.6 km^2) subwatersheds experiencing the most woodland loss, followed by the Ottawa East (-1.7 km^2) and Kemptville Creek (-1.5 km^2) subwatersheds. These losses can be attributed primarily to the conversion of woodland to agricultural, commercial, industrial, institutional and residential land uses.

Figure 3.9 shows a range of woodland cover percentages across the watershed's catchments in 2020 along with a symbolic representation of the amount of woodland area loss that has occurred between 2008 and 2020. Table 3.10 provides statistics about the area and percentage of woodland in 2008 and 2020 by subwatershed.

FIGURE 3.9 Woodland cover in the Rideau River Watershed, 2020

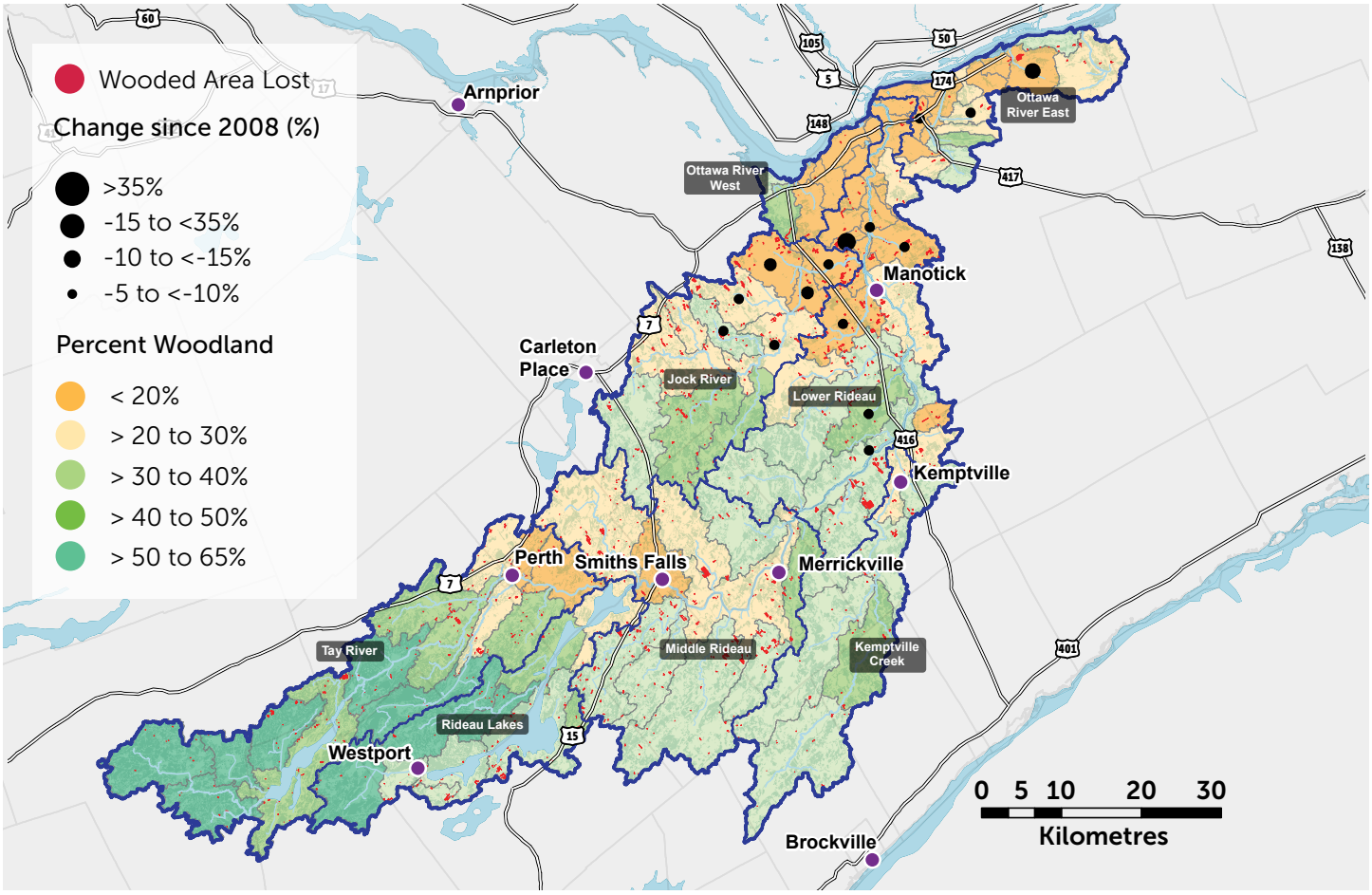


Table 3.10 Subwatersheds: Woodland Cover [1, 2]

Rideau Subwatersheds: Woodland Cover	2008		2020		2008 to 2020		
	Area		Area		Change		
	km²	Percent	km²	Percent	km²	Percent	Trend
Tay River	374.75	46.89	373.73	46.76	-1.02	-0.27	↓
Rideau Lakes	190.25	41.87	189.62	41.73	-0.63	-0.33	↓
Middle Rideau	267.28	32.35	263.30	31.87	-3.99	-1.49	↓
Kemptville Creek	157.25	34.66	154.81	34.12	-2.44	-1.55	↓
Jock River	165.26	29.10	159.53	28.09	-5.73	-3.47	↓
Lower Rideau	215.24	28.08	206.05	26.88	-9.19	-4.27	↓
Ottawa West	19.54	17.45	19.36	17.28	-0.19	-0.96	↓
Ottawa East	58.58	22.21	56.79	21.53	-1.79	-3.05	↓
Watershed Total	**1,448.16**	**34.13**	**1423.18**	**33.54**	**-24.98**	**-1.72**	↓

1. Includes treed swamps
2. Does not include young age-class regenerative/successional woodland or plantations.

Woodland Patch Size

Larger woodlands are more likely to contain a greater diversity of plant and animal species than smaller woodlands, and they have a greater relative importance for mobile animal species such as forest birds. A larger size also allows woodlands to support more resilient nutrient cycles and food webs, and to be big enough to permit different and important successional stages to co-exist. Small, isolated woodlands and newly regenerated forests – like those driving much of the watershed's recent woodland increases – are more susceptible to the effects of blowdown, drought, disease, insect infestations, and invasions by predators and non-indigenous plants.[9]

Furthermore, bigger forests often provide a niche but critical type of habitat. Many forest birds breed far more successfully in larger forests than they do in smaller woodlots, and some rely heavily on forest interior conditions. Species populations are often healthier in regions with more forest cover and where forest fragments are grouped closely together or connected by corridors of natural habitat.

Conversely, small forests support small numbers of wildlife. Fragmented habitat also isolates local populations, especially small mammals, amphibians and reptiles with limited mobility. This reduces the healthy mixing of genetic traits that helps populations survive over the long run.[10] Also, preservation of some relatively undisturbed large forest patches is needed to sustain forest plants because of their restricted dispersal abilities (i.e. they do not disperse broadly or quickly) and specialized habitat requirements and to ensure continued seed or propagation sources for restored or regenerating areas in the vicinity.

The Ideal Condition

A watershed or other land unit should have at least one, and preferably several, 200-hectare forest patches (measured as forest area that is more than 100 metres from an edge). Forest patches should be within two kilometres of one another, or other supporting habitat features to be of maximum use to species such as forest birds and other wildlife that require large areas of forest habitat. "Big Woods" areas, representing concentrations of smaller forest patches as well as larger forest patches, should be a cornerstone of protection and enhancement within each watershed or land unit.[2]

Woodland Patch Size and Change

The vast majority of the watershed's woodlands are found in the smallest size classes: 5,895 (46.3%) of patches are very small, being less than one hectare in size; another 5,609 (44.1%) of patches range from one to less than 20 hectares, which according to HMHE support few to no area-sensitive forest bird species and are dominated by species tolerant of woodland edges/fringes. The remaining 1,220 (9.6%) of woodland patches are found in the larger size classes: 610 (4.8%) in the 20 to 50 hectare range that may support a few area-sensitive forest bird species; 303 (2.4%) in the 50 to 100 hectare range that will support some area-sensitive forest bird species, but species tolerant of edges/fringes will dominate; 197 (1.5%) in the 100 to 200 hectare range that will support approximately 60% of area-sensitive forest bird species including most area-sensitive species, and 110 (0.9%) in the 200-hectare-plus range that will support about 80% of edge-intolerant forest bird species (including most area-sensitive species) that prefer interior forest habitat conditions. Twenty-one of the 200 hectare-plus sized woodlands exceed the 500 hectares threshold considered essential for the long-term survival of forest bird populations and individual forest bird species, such as the area-sensitive Ovenbird.

Between 2008 and 2020, there has been an increase of 260 woodland patches in the watershed, but an overall decrease of 2,233 hectares in woodland area, which is broken down in detail in Tables 3.11 and 3.12. Most of the patch count increase has occurred in the less than one hectare size class, where there are now 267 more woodland patches in 2020 as compared to 2008.

This can be mainly attributed to decreases in the number and areal loss of woodlands within the 50 to 100 hectare size class and 100 to 200 hectare size class, with 20 patches totalling 2,269 hectares lost between these two categories. This accounts for 98 percent of total woodland loss between 2008 and 2020, and has contributed to an even more fragmented woodland landscape in the Rideau River Watershed.

Tables 3.11 and 3.12 provide Rideau River Watershed statistics about the number and area of woodland patches counted within six woodland patch size classes in 2008 and 2020. Figures 3.10 and 3.11 provide graphic presentations of the number and area of woodland patches in the watershed within each class in 2020.

Table 3.11 Rideau River Watershed: Woodland Patches*

Rideau Watershed: Woodland Patch Size Classes	2008				2020			
	Number		Area		Number		Area	
	Count	Percent	Ha	Percent	Count	Percent	Ha	Percent
< 1 ha	5628	45.15	2,463.21	1.70	5895	46.33	2,554.17	1.79
1-20 ha	5601	44.94	26,075.77	18.01	5609	44.08	25,925.83	18.18
20-50 ha	605	4.85	18,682.14	12.90	610	4.79	18,882.83	13.24
50-100 ha	310	2.49	21,863.78	15.10	303	2.38	21,493.02	15.07
100-200 ha	210	1.68	29,328.99	20.25	197	1.55	27,430.43	19.24
> 200 ha	110	0.88	46,395.45	32.04	110	0.86	46,289.50	32.47
Totals	**12,464**	**100.00**	**144,809.33**	**100.00**	**12,724**	**100.00**	**142,575.79**	**100.00**

* Includes treed swamps

Table 3.12 Rideau River Watershed: Woodland Patches Change*

Rideau Watershed: Woodland Patch Size Classes	2008 to 2020					
	Change					
	Number		Area		Number	Area
	Count	Percent	Ha	Percent	Trend	
< 1 ha	+267	4.74	90.96	3.69	↑	↑
1-20 ha	+8	0.14	-149.94	-0.58	↑	↓
20-50 ha	+5	0.83	200.69	1.07	↑	↑
50-100 ha	-7	-2.26	-370.76	-1.70	↓	↓
100-200 ha	-13	-6.19	-1898.56	-6.47	↓	↓
> 200 ha	0	0.00	-105.94	-0.23	↔	↓
Totals	**260**	**2.09**	**-2,233.54**	**-1.54**	↑	↓

* Includes treed swamps

FIGURE 3.10 Woodland and Woodland Interior Patch Numbers within Six Size Classes

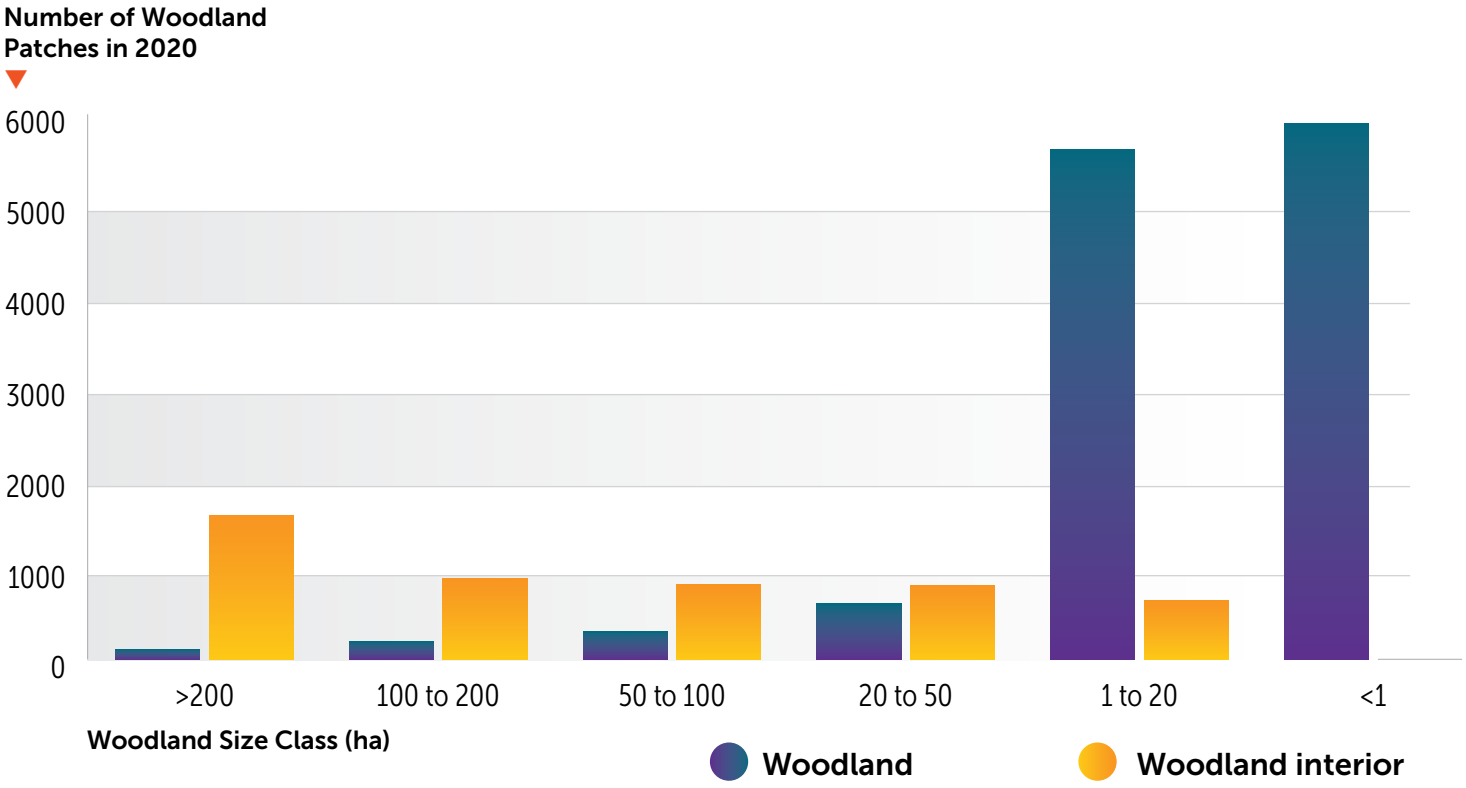
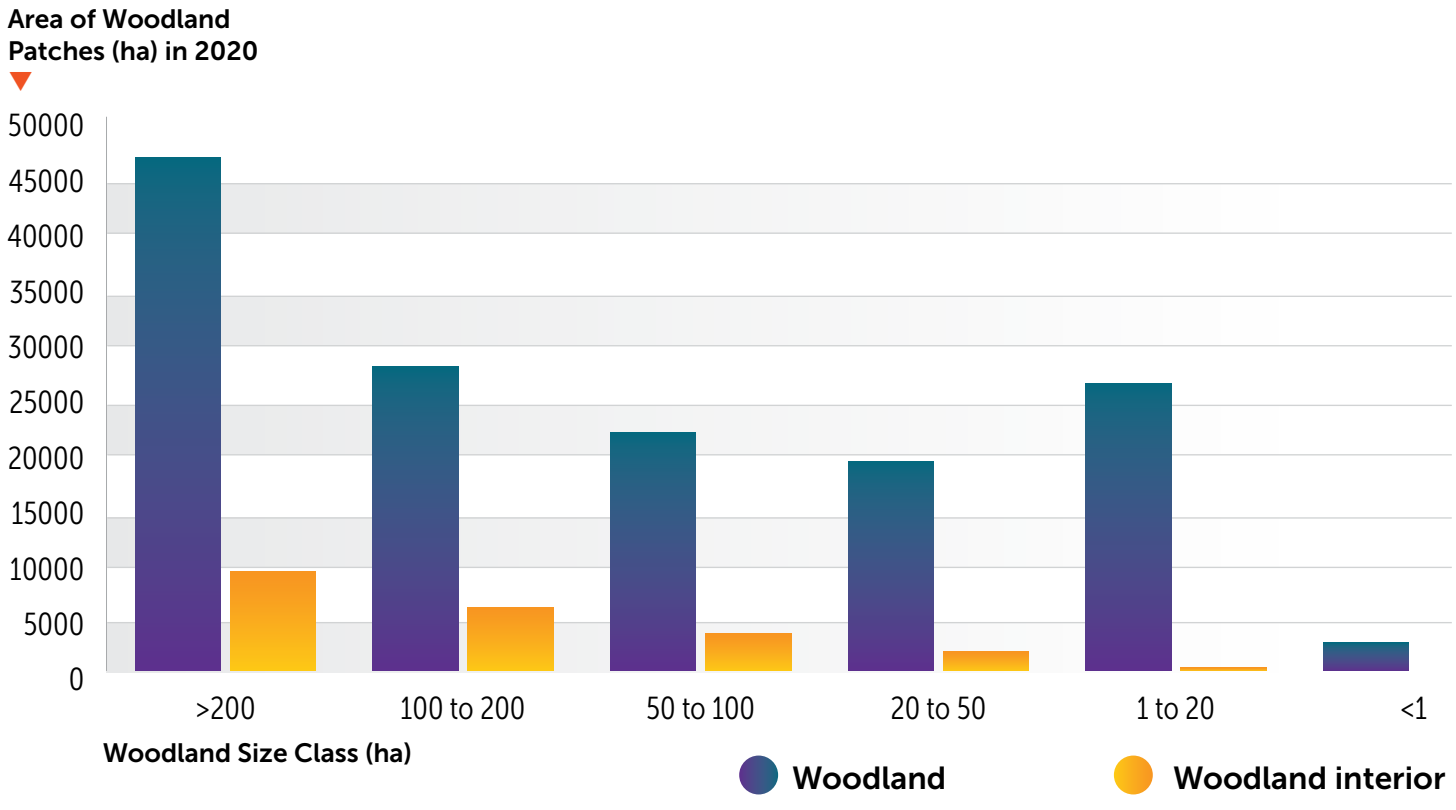


FIGURE 3.11 Woodland and Woodland Interior Area within Six Size Classes



Woodland Interior Habitat

The forest interior is habitat deep within woodlands and is defined as habitat more than 100 metres from the woodland edge. Some people call it the "core" or the "heart" of a woodland. The presence of forest interior is a good sign of woodland health and is directly related to the woodland's size and shape. Large woodlands with round or square outlines have the greatest amount of forest interior. Small, narrow woodlands may have no forest interior conditions at all. Forest interior habitat is a remnant natural environment, reminiscent of the extensive, continuous forests of the past. This increasingly rare forest habitat is now a refuge for certain forest-dependent wildlife; they simply must have it to survive and thrive in a fragmented forest landscape.[4]

Woodlands with large "core" areas provide for relative seclusion from outside influences and have centers that are more clearly buffered against the edge effects of agricultural activities or more harmful urban activities than those without it. Such areas can accommodate a broader range of diverse habitats and micro-habitats created by stochastic events (e.g., tree falls), as well as a range of successional stages of each habitat type, each with the potential to support different species. The presence of these elements in a landscape or watershed enhances biodiversity and increases resilience to natural stressors such as disease, insect infestation and climate change induced stresses like extreme drought and windstorms.[2]

The Ideal Condition

The proportion of the watershed that is forest cover and 100 metres or further from the forest edge should be greater than 10%.[2]

Woodland Interior Habitat and Change

The vast majority of woodland interior habitat is located within the largest woodlands in the watershed: 110 woodlands greater than 200 hectares contain 44.7% of the watershed's "core" woodland (9,012 ha), with 197 woodlands between 100 and 200 hectares in size containing another 28.4% (5,736 ha). Another 16.7% is housed in 303 woodlands in the 50 to 100 hectare category (3,369 ha). The remaining 10.2% of "core" interior habitat is found in smaller woodlands yet: 610 woodlands between 20 to 50 hectares contain 8.6% of "core" woodland (1,733 ha), with the final 1.6% of interior habitat divided between 5,609 one to 20 hectare sized woodlands – splitting a mere 326 hectares among them. Another 5,895 woodlands contain no interior habitat whatsoever.

These statistics confirm that the largest 307 woodlands are disproportionately more important than the watershed's smallest 11,504 woodlands for maintaining healthy populations of forest interior dwelling species, relative to their number.

Between 2008 and 2020, a total of 869 hectares of "core" woodland was lost within the RVCA jurisdiction, representing a 4.1% decline in the overall amount of woodland interior which is broken down in detail in Table 3.13 and 3.14 below. The largest losses have occurred in the 100 to 200 size class, where 535 hectares of woodland "core" has disappeared, accounting for 61 percent of all woodland interior losses in the watershed. This mirrors declines in the number and area of woodlands within the same size class, representing 75 percent of total woodland loss (-1,899 ha). All other substantive woodland interior losses have taken place in the 50 to 100 and greater than 200 hectare size classes (-144 ha and -195 ha respectively). These reductions have contributed to an even more fragmented woodland landscape in the watershed, where it has now become even harder for many area-sensitive plant and animal species to survive.

The largest losses have occurred in the 100 to 200 size class, where 535 hectares of woodland "core" has disappeared, accounting for 61 percent of all woodland interior losses in the Rideau Watershed.

Tables 3.13 and 3.14 provide statistics about the number and area of woodland interior patches in 2008 and 2020 within five size classes. Figures 3.10 and 3.11 above provide graphic presentations of the number and area of woodland interior patches within the same size classes in 2020.

Table 3.13 Rideau Watershed: Woodland (Core) Interior*

Rideau Watershed: Woodland Patch Size Classes	2008				2020			
	Number		Area		Number		Area	
	Count	Percent	Ha	Percent	Count	Percent	Ha	Percent
1-20 ha	656	13.62	331.68	1.58	649	13.64	326.40	1.62
20-50 ha	819	17.01	1,722.68	8.19	815	17.13	1,732.29	8.59
50-100 ha	824	17.11	3,512.87	16.69	823	17.29	3,369.07	16.70
100-200 ha	946	19.65	6,271.09	29.80	886	18.62	5,735.75	28.43
> 200 ha	1,570	32.61	9,207.10	43.75	1586	33.33	9,012.08	44.67
Totals	**4,815**	**100**	**21,045.42**	**100**	**4759**	**100**	**20176.22**	**100**

*Includes treed swamps

Table 3.14 Rideau Watershed: Woodland (Core) Interior Change

Rideau Watershed: Woodland Patch Size Classes	2008 to 2020					
	Change					
	Number		Area		Number	Area
	Count	Percent	Ha	Percent	Trend	
1-20 ha	-7	-1.1	-5.28	-1.59	↓	↓
20-50 ha	-4	-0.5	10.24	0.59	↓	↑
50-100 ha	-1	-0.1	-143.80	-4.09	↓	↓
100-200 ha	-60	-6.3	-535.34	-8.54	↓	↓
> 200 ha	16	1.0	-195.02	-2.12	↑	↓
Totals	**-56**	**-1.2**	**-869.20**	**-4.13**	↓	↓

*Includes treed swamps

Changes to Interior Habitat by Subwatershed

The Kemptville Creek Subwatershed has the highest percentage of woodland interior habitat at 6.8%, followed by the Tay River, Middle Rideau and Jock River Subwatersheds at 4.8% and, Lower Rideau and Rideau Lakes Subwatersheds at 4.7% and 4.0% respectively. Ottawa East and Ottawa West have even less interior woodland habitat, which occupies 2.8% and 2.6% of their geographic areas. All RVCA subwatersheds fall well below the ten percent figure referred to in HMHE as the minimum threshold for woodland interior habitat critical for supporting edge-intolerant bird species and other forest species requiring this type of special habitat.

Table 3.16 provides a detailed breakdown of woodland (core) interior by subwatershed along with the changes that have taken place between 2008 and 2020.

All subwatersheds have trended downward through this period, with four of them experiencing the bulk of woodland interior losses by area: the Lower Rideau (-278 ha), Jock River (-191 ha), Middle Rideau (-133 ha) and Kemptville Creek (-108 ha). Lesser losses have also occurred in the Ottawa East (-78 ha), Tay River (-40 ha), Ottawa West (-25 ha) and Rideau Lakes (-17 ha) subwatersheds.

In percentage terms, the Ottawa East and Ottawa West Subwatersheds have seen the largest declines in forest interior (-9.5 and -7.9 percent respectively), followed by the Lower Rideau (-7.1%) and Jock River (-6.5%) Subwatersheds. Smaller declines have occurred in the Kemptville Creek (-3.4%), Middle Rideau (-3.2%), Tay River (-1.0%) and Rideau Lakes (-0.9%) subwatersheds.

These forest interior reductions are directly linked to the loss of overall woodland cover reported for all RVCA subwatersheds between 2008 and 2020 (Table 3.10).

Table 3.15 Subwatersheds: Woodland (Core) Interior*

Rideau Subwatersheds: Woodland Interior	2008		2020		2008 to 2020 Change		
	Area		Area		Area		
	Ha	Percent	Ha	Percent	Ha	Percent	Trend
Tay River	3,911.68	4.89	3,871.38	4.80	-40.30	-1.03	↓
Rideau Lakes	1,857.00	4.09	1,840.19	4.05	-16.82	-0.91	↓
Middle Rideau	4,120.08	4.99	3,986.73	4.83	-133.35	-3.24	↓
Kemptville Creek	3,207.01	7.07	3,099.23	6.83	-107.78	-3.36	↓
Jock River	2,921.69	5.14	2,730.95	4.81	-190.74	-6.53	↓
Lower Rideau	3,892.70	5.08	3,615.10	4.72	-277.60	-7.13	↓
Ottawa West	316.86	2.83	291.91	2.61	-24.95	-7.88	↓
Ottawa East	818.40	3.10	740.73	2.81	-77.66	-9.49	↓
Watershed Total	**21,045.42**	**4.96**	**20,176.22**	**4.75**	**-869.20**	**-4.13**	↓

*Includes treed swamps

Woodland Targets, Thresholds and Impacts

Table 3.16 provides a summary of woodland statistics, targets and thresholds in year 2020. All Rideau Subwatersheds fall short of the 50 percent woodland cover threshold that corresponds to a low-risk approach that is likely to support healthy aquatic systems and most of the watershed's potential species. Only the Tay River and Rideau Lakes Subwatersheds meet the next-best threshold of 40 percent for woodland cover, which represents a medium-risk approach to conservation planning, which is likely to support more than one half of the potential species richness and moderately healthy aquatic systems.

The Middle Rideau and Kemptville Creek subwatersheds meet the minimum 30 percent threshold recommended in the HMHE Guideline, which equates to a high-risk approach that may only support less than one half of the potential species richness and marginally healthy aquatic systems. The Jock River, Lower Rideau, Ottawa East and Ottawa West Subwatersheds do not meet any HMHE woodland cover thresholds.

For woodland interior habitat, not one of the watershed's subwatersheds meets the HMHE 10 percent woodland interior target that is recommended as the minimum figure for the protection of adequate "core" habitat in landscape-scale natural heritage planning.

For woodland patch size, all subwatersheds but one meet the "greater than" target of having at least one 200-hectare-plus woodland, with the exception being Ottawa East. Ottawa West has only one 200-hectare-plus woodland, and could be susceptible to dropping below this critical threshold.

Table 3.16 Subwatersheds: 2020 Woodland Statistics, Targets and Thresholds

Rideau Subwatersheds: Woodland Statistics, Targets and Thresholds	Woodland Cover (2020)					Woodland Interior (2020)			Woodland Patches (2020)	
	Area		Thresholds			Area		Target: 10% or more interior	Target: one or more patches ≥200 ha	
	km²	%	30%	40%	50%	km²	%	Meets	Number	Meets
Tay River	374.75	46.89	---	✓	---	38.71	4.80	✗	30	✓
Rideau Lakes	190.25	41.87	---	✓	---	18.40	4.05	✗	19	✓
Middle Rideau	267.28	32.35	✓	---	---	39.87	4.83	✗	21	✓
Kemptville Creek	157.25	34.66	✓	---	---	30.99	6.83	✗	16	✓
Jock River	165.26	29.10	✗	---	---	27.31	4.81	✗	7	✓
Lower Rideau	215.24	28.08	✗	---	---	36.15	4.72	✗	15	✓
Ottawa West	19.54	17.45	✗	---	---	2.92	2.61	✗	1	✓
Ottawa East	58.58	22.21	✗	---	---	7.41	2.81	✗	0	✗
Watershed Total	**1,448.16**	**34.13**	✓	**---**	**---**	**201.76**	**4.75**	✗	**109**	**---**

IMPACTS AND IMPLICATIONS

A Woodland Cover

The loss of 22.3 km^2 of "true" woodland in the Rideau River Watershed between 2008 and 2020 is a cause of major concern, especially within the Jock and Lower Rideau Subwatersheds. This loss is further compounded by the fact that only four of eight Rideau Valley subwatersheds meet the 30% woodland cover minimum required to protect and sustain the ecological health of a watershed. None of the subwatersheds meet the ideal 50% woodland cover threshold required for optimal biodiversity and hydrological function.

This could have major consequences for those municipalities and agencies responsible for protecting and managing the watershed's natural resources, given the important role that woodlands play in the hydrologic cycle and their critical contribution to sustaining the overall water balance of the watershed. The lack of adequate woodland cover also reduces how much carbon our forests can sequester and store within their wood fibres and below ground in the soils - which is more urgent than ever given the ever increasing and dire threat from the effects of global warming.

B Woodland Patch Size and Woodland Interior

Woodland patch size and woodland interior habitat are two closely associated metrics due to the fact that any change in the size of a given woodland has a direct ecological effect on its "core" woodland interior. The reported losses in the total amount of woodland cover in the watershed have further exacerbated the loss of remaining interior habitat within the Rideau Valley. At a watershed average of 4.6%, not one of eight subwatersheds meets the 10% woodland interior guideline for protecting area-sensitive bird species and other sensitive woodland species. Furthermore, accordingly to HMHE, the large reported losses of woodland interior between 2008 and 2020 will result in a corresponding loss in the number of area-sensitive species and non-edge habitat and consequently a decline in overall biodiversity and health of a watershed's ecosystems.

As interior habitat is considerably below the recommended HMHE guideline, all remaining woodland interior habitat in the RVCA jurisdiction should be protected. Small woodland core areas, while they likely do not support area sensitive species, can act as nodes for expansion through stewardship or restoration, enabling support of these species in the future. The challenge, going forward, is to stop the reported losses in woodland area, size and "core" interior, as many critical woodland thresholds have already been breached. We must continue the task of afforesting and reforesting those subwatersheds identified as being below the criteria shown in Table 3.16.

Endnotes

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