

SUMMER'S OVER

Evolution has endowed
the big-footed snowshoe hare
with a particularly nifty skill.
Over a period of about 10 weeks
as autumn days shorten
in the high peaks and boreal forests
the nimble nocturnal hare
transforms itself.
Where it was once
a tawny brown
to match the pine needles
and twigs amid which it forages
the hare turns silvery white
just in time for the falling
of winter snow.
This transformation
is no inconsequential feat.
Lepus americanus
is able to jump
10 feet and run
at a speed of 27 miles per hour
propelled by powerful hind legs
and a fierce instinct to live.
But it nonetheless ends up
86 per cent of the time
as a meal for a lynx,
red fox coyote or even
a goshawk or great
horned owl.
The change of coat
is a way to remain
invisible to hide
in the brush or fly over
the snow unseen
long enough at least
to keep the species going.
Snowshoe hares are widely
spread throughout the colder
higher reaches of North America
in the wilderness

of western Montana
on the coniferous slopes
of Alaska and in
the forbidding reaches
of the Canadian Yukon.
The Yukon is part
of the Beringia
an ancient swathe
of territory that linked
Siberia and North America
by a land bridge that
with the passing
of the last Ice Age
11,000 years ago gave way
to the Bering Strait.
All manner of mammals
plants and insects ferried east
and west across that bridge
creating over thousands of years
the rich boreal forest.
But in this place north
of the 60-degree latitude
the axiom of life
colored by stinging cold
early snow and concrete
ribbons of ice has been upended
in the cosmic blink of an eye.
The average temperature
has increased by 2 degrees Celsius
in the past half century
and by 4 degrees Celsius
in the winter. Glaciers
are rapidly receding releasing
ancient torrents of water
into Kluane Lake
a 150-square-mile reflecting pool
that has been called a crown jewel
of the Yukon.
Lightning storms, ice jams
forest fires, rain
these things are suddenly
more common.
Permafrost is disappearing.
Such rapid-fire changes
across a broad swathe
of northern latitudes

are testing the adaptive
abilities of the snowshoe hare
however swift and nimble
it might be.
Snow arrives later.
Snow melts earlier.
But the hare changes its coat
according to a long-set schedule
which is to say that the snowshoe
is sometimes snowy white
when its element
is still robustly brown.
And that makes it an easier target
for prey. In 2016
wildlife biologists who tracked
the hares in a rugged wilderness
in Montana gave this phenomenon
a name: climate change-induced
camouflage mismatch.
The hares moulted
as they always had.
It's just that the snow
didn't come.
Survival rates dropped by 7 per cent
as predation increased.
In order to outwit
its newest enemy -
warmer winters -
snowshoe hares would need
something in the order of
a natural miracle
what the biologists called
an evolutionary rescue.
Like the Yukon
this pristine corner
of Montana was projected
to lose yet more snow cover -
there would be perhaps
an additional month
of bare forest floor
by the middle of this century
on which snowshoe hares
would stand out
like bright white balloons.

In the tally of species

that will evolve or perish
as temperatures rise
now consider the moose.
The lumbering king
of the deer family
known for antlers that can span
six feet like giant
outstretched fingers
the moose faces a litany
of survival threats
from wolves and bears
to brain worms and liver fluke
parasites. But in the late 1990s
in many northern states
and Canada something else
began to claim adult cows
and bull moose and
in even greater numbers
their single or twin calves.
Lee Kantar is the moose
biologist for the state
of Maine which means
that he makes a living
climbing the rugged terrain
of north-central Maine
when a GPS collar indicates
a moose has died.
A lean man with a prominent
salt-and-pepper moustache
who wears flannel shirts
and jeans to work
Kantar tagged 60 moose
in January of 2014
around Moosehead Lake
in the Maine Highlands.
By the end of that year
12 adults and 22 calves were dead –
57 per cent of the group.
When biologists examined
the carcasses they found
what they thought was the cause.
Calves not even a year old
harbored up to 60,000
blood-sucking arthropods
known as winter ticks.
In Vermont

dead moose were turning up
with 100,000 ticks
each. These magnificent animals
were literally being
bled to death.
Winter ticks have been known
to afflict moose
since the late-1800s.
In a normal year
a single moose
might carry 1,000
or even 20,000 ticks.
In a particularly harsh winter
when moose are underfed and weak
anemia and hypothermia
wrought by ticks
can make the difference
between life and death.
Bill Samuel a biology
professor now retired
from the University of Alberta
has spent a career studying
the moose of North America.
He painstakingly counted
149,916 ticks on a moose
in Alberta in 1988.
In a 2004 book he recounts
episodes of ticks killing moose
in Saskatchewan in the spring
of 1916 in Nova Scotia
and New Brunswick in the 1930s
and in Elk Island National Park
in central Alberta at points
from the 1940s to the 90s.
Some of the animals were so infested
that there was not a tick-free spot
in the arachnids favored places –
the anus, the inguinal area
the sternum, the withers
and lower shoulders.
In futile attempts
to rid the parasite
these pathetic animals
had rubbed against
trees to seek relief
losing long lustrous fur

and leaving greyish
mottled patches.
They are called ghost moose.

Moose have long died
from disease predators hunting
and sometimes ticks.
But their losses in the early
21st century had a different
more threatening more
consequential implication.
Moose like and need
the cold. They become
sluggish when it's warm
failing to forage
as they should and becoming
weak and vulnerable.
In the warmer shorter
winters of the U.S. Midwest
and Northeast bumper
crops of winter ticks
are surviving to wake up
when the trees burst
to life in earlier springs
they have more time
in longer falls to cling
in veritable swarms
on the edges
of high bushes
their legs outstretched
waiting for a ranging
unsuspecting and wholly
unprepared moose.
When the moose lie
in the snow they leave
carpets of blood
from engorged ticks.
When a baby moose emerges
from the womb in Minnesota
a band of thirsty ticks
moves from mother to neonate.
The moose shed those fat
flush ticks onto fall
and winter ground
and the ticks snuggle
into the leaf litter

rather than freeze
in the snow as they once
might have reducing tick
mortality but upping
that of the moose.

Jill Auerbach knows
that the winter ticks
attached to dead and dying
moose pose little threat
as a species to humans
whom they aren't prone
to bite. But when news broke
of moose losing half their blood
to winter ticks she was horrified
and worried. Auerbach
was bitten in her 40s
by a small tick that thrives
in the woods thickets and
backyard edges of the county
in which she lives
in New York States
Hudson Valley.
She lost 10 years of her life
to that tick had to retire
as a highly-rated programmer
at the nearby IBM plant
and still suffers the aftermath
of a case of Lyme disease
that was caught too late.
It brought me to my knees
said Auerbach. To her the rise
of winter ticks is one more
indicator of an environment
out of whack and so is the more
measured but nonetheless relentless
surge in blacklegged ticks
like the one whose bite
haunts her 30 years on.
That other tick
known to scientists as part
of the *Ixodes* genus
is spreading across
the U.S. and many other countries
with startling alacrity.
Canada, the United Kingdom

Germany, Scandinavia, Inner Mongolia
in China and the Tula
and Moscow regions in Russia:
they are all grappling
with large and growing numbers
of disease-ridden ticks.
Infected ticks have been found
in urban parks in London
Chicago and Washington, DC
and in the open green expanses
of Killarney National Park
in Ireland's southwest.
In western Europe where
case reporting is not standardized
the official case count is
85,000 per year -
a 2016 analysis put the number
at 23,200. Signs of a burgeoning
problem are apparent in Japan
Turkey and South Korea
where Lyme cases grew from none
in 2010 to 2,000 in 2016.
The U.S. Centers for Disease
Control and Prevention
in Atlanta issues maps
every year showing
by virtue of small black dots
the presence of Lyme disease
cases in U.S. counties.
The CDC's 1996 map
was the first to officially chart
U.S. Lyme cases although
the disease was well along
by then. Dots on that inaugural
map collectively create
an unremitting black smudge
along the Atlantic shore
from Delaware to Cape Cod.
New Jersey, Connecticut
Massachusetts and the lower
reaches of New York State
are all inky black.
A broken shadow
runs along the Wisconsin-
Minnesota border too
with a handful of dots

in many heartland states.
But it is the change
over the course of 18 years
of maps that is telling –
depicting the flowering
of Lyme in a sort of cartoon
flip-book style as it spreads
across the Northeast
and Midwest of the U.S..
North it goes up New York's
Hudson River Valley
and into the state's Adirondack
Mountains jumping the border
to Vermont's Green and
New Hampshire's White
Mountains. West and south
it moves great guns into Maryland
and northern Virginia.
By 2014 the dots consume
much of Pennsylvania and darken
New York's Southern Tier
to the shores of the Great Lakes
and the St Lawrence River.
The Upper Midwest is
liberally peppered.
Dots appear
in many other states too.
In 1996 blacklegged ticks
were known to be established
in 396 U.S. counties.
By 2015 researchers at CDC
reported that the ticks
were ensconced in 842 counties
an increase of 113%.
Remarkably the study's two maps
of the continental U.S.
chart the march of ticks
in much the way that the Lyme
maps plotted the progress of disease.
Ticks are seen moving
into places that only a decade before
had been considered ill-suited
to support them
from the Allegheny Mountains
to the Mississippi Valley
from western Pennsylvania

south and east across Kentucky
and Tennessee. In Minnesota
and Wisconsin *I scapularis*
appears to have expanded
in all cardinal directions.
The ticks have spread
inland from the Atlantic seaboard
and expanded in both northerly
and southerly directions
stopped only to the east
by the Atlantic Ocean.
Tick movement up the Hudson
Valley is recent and rapid
their expansion overall dramatic.
Where there had once been
a divide between infestations
in the Northeast and Midwest
ticks merge to form
a single contiguous focus
a shifting landscape of risk
for human exposure
to medically important ticks.

The CDC does not use the word
epidemic to describe
Lyme disease. It prefers the term
endemic which it defines as
the constant presence
and/or usual prevalence
of a disease or infectious agent
in a population within
a geographic area.
But surely Lyme
was not always present
or prevalent.
Nor is it confined
within well-defined borders.
Lyme disease is moving
breaking out and spreading like
an epidemic.
The ticks that carry
Lyme disease are not insects.
Although they cannot fly or jump
they are for all practical purposes
climbing mountains

crossing rivers
and traversing hundreds
even thousands of miles
to set up housekeeping.
These feats are documented
by scientists who are ingenious
at finding ways to track
and count ticks. They drag
white flannel sheets
across leafy forest carpets
sometimes infusing them
with piped-in carbon dioxide –
the mammal gas that makes
ticks reach up forelegs
outstretched to snag
a passing meal. They catch
avian migrants infested
with hitchhiking arachnids.
They count ticks on the ears
of trapped mice and shrews
sometimes getting
bitten in the process.
They dissect bird nests
reach beneath leaf litter
and scour grassy sand dunes.
When these researchers are lucky
they find data from some other era
that proves their hunch that
something has changed.
Ticks are aggressively
moving up. The DNA data
strongly support a progressive
south-to-north expansion.
Defying the odds the ticks
had moved to places where
it had long been colder
and snowier. And they did
just fine.

In states from Maine
to Florida and New York
to California across the breadth
of southern Canada
and in many parts of Europe
once-sweeping woodlands
have been reduced and divided

often into idealized forest fragments
at the periphery of residential tracts
places where people
can be close to support
and observe wildlife.
Multitudes live, work
and play in or near
these green spaces.
The irony is that these
adulterated slices of nature
and *de facto* nature preserves
are incubators of Lyme disease.
The smaller the patch
the higher the proportion
of diseased ticks.
In these fragments
small mammals
such as white-footed mice
in North America and
garden dormice in Europe
have found havens
thriving in the absence of predators
such as foxes. In the language
of tick-borne disease
the mouse is quaintly called
a host for ticks and a reservoir
of Lyme disease – the place
where baby ticks almost too small
to be seen get their first sip
of infection. In city parks
suburban tracts and exurban preserves
people come skin-to-skin
with these ticks.
Lyme disease is moving
to new places as it has for nearly
half a century. *Ixodes* ticks
blacklegged, castor bean
or otherwise – deserve our respect.
They come armed not only
with Lyme disease but with a growing
menu of microbes: bacterial
viral and parasitic, known
and yet unnamed. Ticks can
and sometimes do deliver two
three or four diseases in one bite.
So resourceful are infected ticks

that two feeding side by side
on the same animal can pass
pathogens one to the other
and never infect the host.
So clever is the Lyme pathogen
that infected ticks are more efficient
at finding prey than uninfected ticks.
These ticks might not be able
to fly or jump or trek
more than a couple of human steps.
But they have changed many lives
cost billions in medical care
and colored a walk in the woods
or a child's romp in the grass
our very relationship with nature
with angst. This is all the more
disturbing when we realize
ultimately that it is we
who unleashed them.