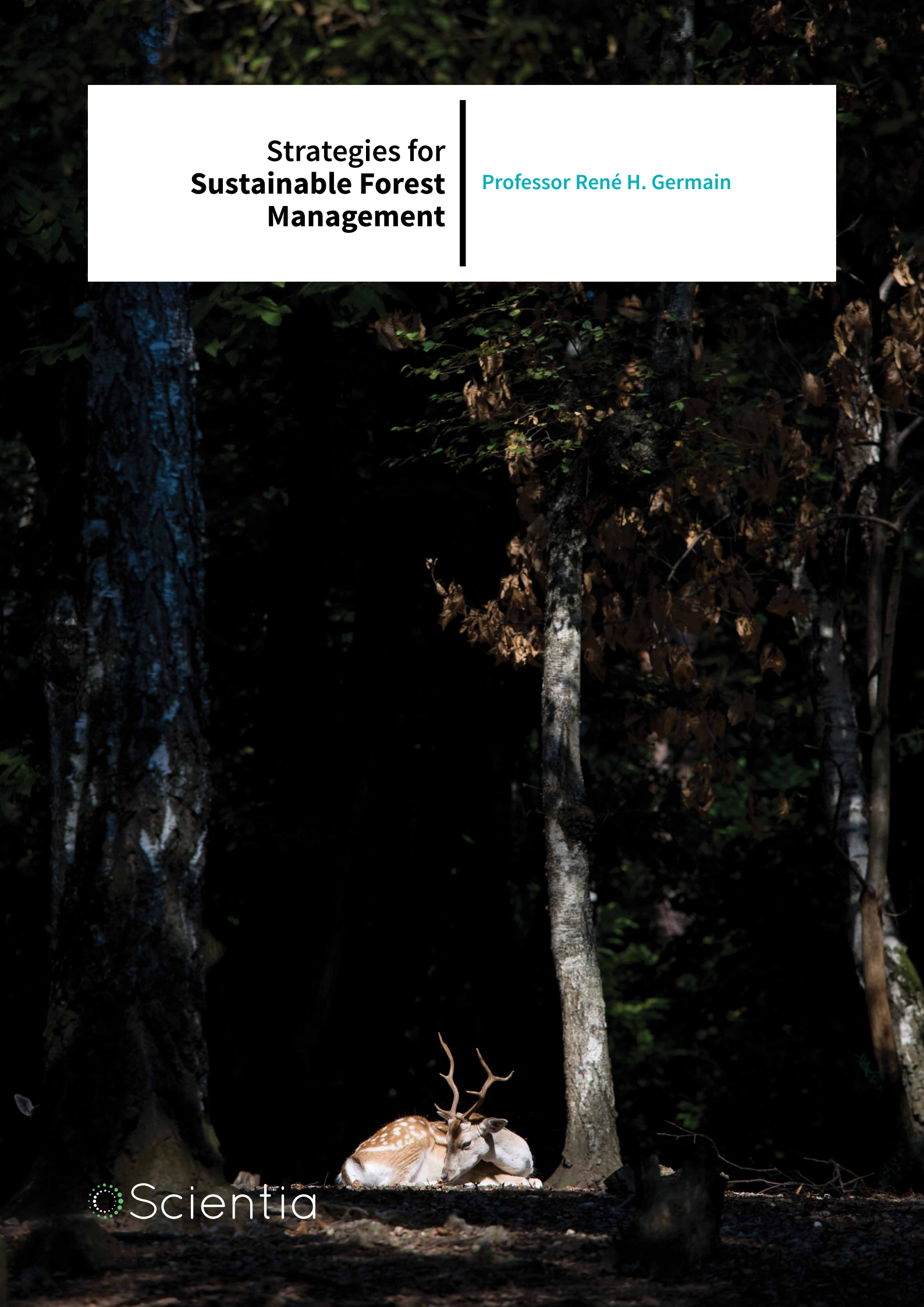
Strategies for Sustainable Forest Management

Professor René H. Germain



Scientia

STRATEGIES FOR SUSTAINABLE FOREST MANAGEMENT

Forested land improves urban water quality, but needs to be appropriately managed and protected from the impacts of land use changes. **Professor René Germain** at SUNY ESF is passionate about improving the sustainability of forest management, and carries out research and outreach programs to build knowledge and explore better management practices.

The Model Forests of the New York City Watershed

Forests are vital habitats for many species and make important contributions to human welfare. As well as timber, they provide essential ecosystem services such as absorbing carbon dioxide, moderating weather, and purifying air and water supplies for both rural and urban communities. Despite this, forested land is threatened globally due to increasing demand for land as a result of a growing human population. Well-designed management strategies are essential to ensure the long-term future of forests and all the benefits they offer.

Professor René Germain is a scientist working to improve the sustainability of the forest products industry in the US. He explores how land use changes and different forestry systems affect management practices. Based at the State University of New York College of Environmental Science & Forestry (SUNY-ESF) in Syracuse, New York, he also has first-hand experience of forestry through previous work as a forester and vice-president of a lumber company. This experience has given him particular insights into what makes a sustainable forestry system, and which knowledge gaps need to be filled to improve management.

Professor Germain is convinced that a critical aspect of achieving better forestry practices is targeted outreach and education programmes. Since 1998, he has coordinated the Model Forests Program, a network of four demonstration forests in the New York City (NYC) Watershed that are designed to showcase good forest stewardship. The NYC Watershed is a 2,000 square-mile lushly forested area containing nineteen reservoirs, three controlled lakes, and three major watersheds – the Catskill, Delaware, and Croton.

The Model Forests are collaborative projects. Though overseen by the Forestry Program of the non-profit NYC Watershed Agricultural Council (WAC), multiple organisations contribute to their ownership, maintenance and stewardship, including the US Forest Service, the NYC Department of Environmental Protection, SUNY-ESF, Cornell Cooperative Extension, Frost Valley YMCA, and Green Chimneys. The Model Forests 'outdoor laboratories' are for scientists to compare the long-term effects of different silvicultural approaches on forest ecosystems and water quality. They also model best management practices (BMPs), widely-used tools to maintain water quality and improve the sustainability of forestry operations.

Each Model Forest is linked to an environmental education centre. Visiting these forests is an exciting opportunity for landowners, policy-makers and the public to see first-hand how logging, nature, and water quality protection can coexist. The experience helps visitors build understanding and find common ground, improving their ability to contribute to sustainable and economically viable forestry.

In their 2007 article in the *Journal of Extension*, Professor Germain and his colleagues discuss the effectiveness of the Model Forest approach. 'The Frost Valley

Model Forest is used extensively by the YMCA as part of their environmental science curriculum to 30,000 students annually,' they explained. 'Thus far, the Frost Valley YMCA Model Forest represents our greatest success story in terms of truly integrating research, Extension, and outreach.' On the research front, in a 2011 article in the *Journal of Forest Ecology and Management*, Professor Germain and colleagues from the US Geological Survey report the relation of harvesting intensity to changes in soil and stream chemistry, confirming that light forest thinning operations have negligible effects on water quality.

Forest Fragmentation Can Accelerate Development

One of the greatest threats to water quality in the NYC Watershed is the loss of forestland through land use change. One such change is the gradual transition away from forest resource management to rural residential use through the fragmentation of forests into small 'parcels' of land, which are then used for development.

The increasing parcelization of forests has strong implications for resource management. When parcels drop below a certain size threshold, managing them becomes economically unviable, further increasing the incentive for owners to allow development. This also means that managers are less likely to be able to implement better forestry practices due to their higher costs.

In NYC, parcelization could have a significant impact on the city's water quality and come with a heavy price-tag for the taxpayer. The NYC Watershed supplies over 9 million people in the greater NYC area. Because the Watershed's forests are so efficient at filtering the water supply naturally, the US Environmental Protection Agency has granted NYC a waiver from the federal requirement that surface drinking water supplies pass through a filtration plant. By not needing to build this plant, NYC saves an estimated $10 billion in construction costs and more than $300 million annually in operating expenses.

WAC, NYC and New York State are all keenly aware of the importance of the Watershed's natural filtration, and together they have protected 34% of the Watershed's land area through fee purchases and conservation easements. However, the remaining 66% of Watershed land is privately owned and vulnerable to land use change.

Although there is anecdotal evidence of increasing forest parcelization in the NYC Watershed and beyond, there has been little systematic assessment of its impacts. One open question has been the exact rate at which parcelization is occurring. Professor Germain and his colleagues explored the average parcel size of forests in the NYC Watershed over the 16-year period between 1984 and 2000. The results, published in the *Journal of Forestry* in 2005, show a significant decline in parcel size from 19 to 16 acres. A 2016 paper published in the Journal of Conservation Planning reports an average parcel size of 13 acres in 2010, with one-third of the parcels below the resource management acreage threshold of 30 acres, as reported by Professor Germain and his colleagues in 2009 in the *Journal of Forest Policy and Economics*. The general picture is of increasingly fragmented, small forest parcels, with a continued shift towards the lower size categories. This is worrying news

for the stability of NYC Watershed forests and their ability to filter the water supply, as these smaller forest parcels are more vulnerable to development.

Residential land is associated with impervious surfaces such as brick, stone and pavement, which have a much lower ability than forested land to absorb water. Increasing impervious surface area can raise the likelihood of flooding and of transporting chemical residues into the water supply. Although denser settlements generally have a higher level of impervious surfaces, even low-density rural residential development can damage water quality, through runoff that transports pollution from lawn chemicals, septic systems, animal waste and sediment. Recent research has shown that water quality can be harmed when impervious surfaces occupy as little as 2.4% of a watershed's area.

In their 2012 article in the *Northern Journal of Applied Forestry*, Professor Germain and his colleagues used a combination of field data, digital imagery and landowner surveys to compare the land cover of NYC Watershed parcels subdivided between 1984 and 2005 to that in parcels which remained intact. They showed that with each new subdivided parcel, impervious surface area increases by an average of 3200 square feet (297 square meters), which is likely to impact local water quality. Improved management practices have been effective at reducing pollution from agriculture and forestry operations, and Professor Germain and his team believe that new policies could continue this positive trend, by regulating residential development.

Towards Better Management Practices

BMPs are an essential way of improving forest management. Properly implemented, they can protect local water from the soil erosion and sediment transport that often accompany logging, which could otherwise pollute the water supply. From 1997 to 2015, the non-profit WAC promoted BMPs in the NYC Watershed by funding private landowners to get forest management plans. The plans included detailed information about ways these landowners could manage their forests. Professor Germain led a formative evaluation of BMP implementation in the early 2000s, reporting in a 2005 article in the Northern Journal of Applied Forestry that despite this extensive outreach and extension effort by WAC to promote BMPs, implementation was unacceptably low.

In 2009 and 2011, WAC worked with Professor Germain and his colleagues to find out whether these plans really led to better practices on the ground. They conducted field surveys of recently logged private forests in the NYC Watershed and scored them on their use of BMPs. The results, published in the *Journal of Forestry* in 2013, showed that forests with management plans only scored better in two of six BMP categories.

Because of these research findings, WAC changed its approach to landowner outreach. The non-profit redirected its management plan funding to help landowners enroll in New York's Forest Tax Law Program, which lowers a landowner's property taxes if the owner agrees to follow their management plan and not parcelize or develop their land for ten years. WAC also created a new website for landowners, MyWoodlot.com, that provides owners with ideas and projects to promote forest stewardship.

In addition to working with landowners, WAC also promotes BMPs with foresters and loggers. BMPs often come at a high cost to loggers, so WAC's BMP Program pays loggers a cost-share to install BMPs on forest roads, skid trails, and stream crossings in the NYC Watershed.

Although cost-share programs like WAC's can be an important mechanism to improve forest management practices, their role in ensuring a stable future for the forest depends on whether loggers are able to install BMPs efficiently. If the cost of implementing BMPs is prohibitive, loggers may not use them even if offered a cost-share.

Professor Germain and his collaborators used a case study and a survey to assess how BMPs affect logging costs and productivity. The results, published in a 2017 article in the *Journal of Forestry*, show that both of these effects are highly variable, with BMP costs ranging from $0–62 per acre, and productivity decreasing by 0–20%. Professor Germain's team found that certain operation strategies can reduce these losses, such as using a dozer rather than a grapple skidder to install water bars, and installing BMPs with machines otherwise not in use. Professor Germain and his team also call for a fairer distribution of BMP costs, with other stakeholder groups like sawmills and landowners providing some of the funding instead of relying on loggers alone to absorb the loss.

Ensuring the sustainability of forestry is critical for the viability of the forest products industry. In turn, a viable forest products industry provides income that helps landowners keep their forests as forests, rather than parcelizing them into rural residential developments. Thanks to the efforts of Professor Germain and his colleagues, our improved understanding of land use change drivers and BMPs will help secure forests and their roles in natural and human wellbeing for future generations.

Meet the researcher

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Professor René Germain obtained his BSc in Forestry from the University of Vermont in 1983. In 1988, he received his Master of Science in Business Administration from Boston University, and went on to complete a PhD in Forest Resources Management in 1997 at the SUNY College of Environmental Science & Forestry. He continued his work at SUNY ESF, as Assistant Professor from 1998 to 2003, Associate Professor from 2003 to 2010, and Professor from 2010 onwards. He has also worked in the forest products industry. Professor Germain focuses on research into sustainable forest systems and outreach through the NYC Watershed Model Forests Program, which he coordinates.

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