



Insights from Dr. Marie-Stella Duchiron on Climate Resilience and Sustainable Forest Management

1. What inspired you to write your latest book on forestry, and how does it relate to the growing challenges of drought and wildfires?

Faced with the failures of different forestry methods in the context of current climate disruptions – including forestry referred to as "uneven-aged" or "continuous cover mixed" but in reality, is a form of clear-cut forestry – I sought what is most important for maintaining a forest's constant state, even if the external environment deteriorates. The microclimate of the forest understory is the control center of a forest: it must maintain a certain humidity and nearly constant temperatures, regardless of external disturbances (extreme heat, drought, etc.). The forest microclimate is the most important concept in forest study. To keep it in good condition, you first need:

- 1) very dense forests, similar to old-growth forests with high naturalness;
- 2) many very large, old trees that must remain in the forest;
- 3) a vertically structured, layered canopy.

This is what I call "ecosystem forestry," the only type capable of preserving the wild aspects and characteristics of forests. It is a dense, irregular forestry with a closed canopy. With this ecosystem forestry, the problems of drought and forest fires are resolved. Studies in the USA have shown that young, open forests are highly flammable, and after the fire passes, nothing remains; whereas in old-growth forests with high naturalness, if a fire does develop, its speed is significantly reduced due to the permanent moisture in the understory and the lack of airflow, as the canopy is closed. After the fire passes, many healthy trees remain. Additionally, coniferous forests are the most flammable, which includes all the monoculture plantations from past decades. In ecosystem forestry, hardwood species dominate, with conifers mixed with hardwoods.



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2. As an independent forestry expert, how have you observed the industry evolve in response to climate change?

Government directives aimed at introducing exotic species and opening up forests have no scientific basis and mandate the opposite of what should be done. Perhaps the only foundation for these directives is profitability, both for large nurseries and for a sector of the timber industry that uses exotic and small woods. Some foresters claim to practice park-like forestry with clear-cutting: when the forest cover is reduced to a field of trees with very low density (18 to 20 m²/ha), it can no longer be called a forest, and the tree-by-tree forestry practiced there is equivalent to deforestation in a normal forest.

Climate-Resilient Forests and Anti-Drought/Fire Techniques

3. What are the most effective methods you have identified to make forests more resilient to climate change, particularly droughts and wildfires?

Let's recall that:

- 1) over 90% of forest fires are of human origin (either criminal or accidental);
- 2) areas once grazed by sheep and goats, which used to block the spread of fires, have been repurposed for construction, putting forests on the front line against fires;
- 3) there is also the issue of forestry, particularly coniferous forests, being more prone to fires than forests mixed with predominantly hardwood species.

Additionally, there is a type of forestry that has deviated from the old-growth forest model, which is less vulnerable than young forests. In France, forest fire monitoring has been conducted since the 1990s with the Prometheus database. Since the 1960s and 1970s, a series



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of large fires led to the implementation of a forest defense policy against fires. It is now known that 15,000 hectares burn annually in southern France. The fires that made headlines in the summer of 2022, in France, occurred in even-aged, monoculture coniferous forests. Forest fires have always existed, but the media has only started discussing them in recent years, often dramatizing the situation. Fires are part of natural forest cycles, and researchers have found that fire is beneficial to ecosystems, based on observations in Yellowstone Park and Mount St. Helens in the USA. To resist fires, forests need to be old, very natural, dense, and with a closed canopy. To withstand droughts, the forest's microclimate is the primary factor. To keep it constant, a closed and vertically structured canopy is needed, along with dense forests containing very large, old trees that will never be cut down as they form the backbone of the forest. Only very large, old trees have developed a true mycorrhizal network in the soil, something young forests are incapable of.

4. How can proper management of the water cycle contribute to healthier and more resilient forests?

Again, the most important factor is a closed canopy and a tree-by-tree forestry approach. Research conducted in Baden-Württemberg, Germany, in the Freudenstadt forest, showed unequivocal results from soil analyses for drinking water quality: nitrate filtration in water by the soil is optimal only in the case of selective cutting of beech trees.



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Forest Evaluation and Investment

5. What do you believe are the key factors to consider when assessing a forest under today's climate conditions?

The most important factors to observe are:

- 1) a closed canopy and thus the density of trees, which should be around 35-45 m²/ha (there are old-growth forests with a tree density of up to 70 m²/ha);
- 2) the degree of naturalness of the forest;
- 3) the presence of very large, century-old trees;
- 4) a vertically layered structure;
- 5) native species and a mix of species with a predominance of hardwoods. The natural presence of large fauna (such as deer) is a boon for the forest: their ecological role is now clearly demonstrated, and their impact in some forests is explained by the loss of naturalness, especially the disappearance of tranquil zones.

6. How can investors maximize the long-term value of forests while ensuring sustainability?

The two aspects go hand in hand: a forest where the longevity of all its functions has been preserved will inevitably be more productive in the long term. One must recognize that current climate changes are beneficial to forests because they reveal poor forest management and, more importantly, poor forestry practices. They prompt us to change how we view forests: they should no longer be treated as wood factories, but as ecosystems whose functions are respected. This requires foresters to change their perspectives and methods and become competent in plant physiology and the complex functioning of ecosystems. Before cutting a



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tree, one must ensure that the cut will not excessively disrupt the ecosystem's functioning. This means the forester must understand what is happening in the soil and the understory before intervening. More and more scientific studies show the harmful effects of human interventions on the maintenance of biodiversity and forest productivity.

Outlook

7. What would you most like to share with the participants at our upcoming event in Luxembourg?

A forest's cycle exceeds a human generation's time frame. Therefore, foresters must be very patient and not be swayed by those who have no real understanding of what a forest truly is. All current official forestry practices are actually ligniculture (wood production). Some foresters have had the courage to experiment with more ecosystem-friendly forestry methods: such as the managers of the communal forest in Lübeck, Germany, led by Knut Sturm, whose scientific publications have made significant advances for forestry. This also includes Slovenian and Croatian foresters, with notable work by J. Diaci. Acting too quickly in forests endangers the forests themselves, their ability to mitigate extreme environmental phenomena, filter water, retain it in the soil, and ultimately their long-term productivity, as well as short-term productivity today.

8. What role do you see for innovation and startups in shaping the future of sustainable forestry?

The fundamental problem currently lies within the wood industry, which dictates production orders to foresters. It should be the other way around: the wood industry should adapt to what develops naturally in the forest. It would be desirable for:



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- 1) mobile sawmills to develop;
- 2) sawmills to be equipped with bandsaws capable of processing very large trees;
- 3) a network of small local sawmills to be redeveloped.

Additionally, Germany has capitalized on beech wood, while in France it is mostly used as firewood. The market for beech timber should be revived. Furthermore, forestry education should be improved, particularly in certain engineering schools that, most of the time, only train their students in forest thinning techniques without any expertise in engineering or forest science, including plant physiology and ecology. The optimal hierarchical structure for forest management is the one that has prevailed in Germany so far, with:

- 1) forest center directors who have university degrees and doctorates in forest sciences to continuously improve practices through scientific research;
- 2) highly competent technicians to understand the terrain and enrich discussions with the center director;
- 3) recognized forest workers known for the quality of their manual felling. Needless to say, ecosystem forestry prohibits the entry of industrial harvesters into forests. The forest floor is the forester's working tool, which must be preserved unconditionally.