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THE KEY ROLE OF FORESTS IN DEVELOPING A *TERTIUM QUID*[1] ([2])

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Dear Mr President Prof Ciancio, Dear Ladies and Gentleman,

Buongiorno! It is a great pleasure to be with all of you today in Firenze to open the academic year as an *Honorary Member* of the Italian Academy of Forest Sciences. As a new member of the Academy, today, I would like to share some reflections inspired by a paper published by Prof. Ciancio, President of the Academy a few years ago. A paper discussing the need for a new paradigm for silviculture, to move towards *systemic silviculture.* However, I will not speak about silviculture but try to make you reflect about it indirectly, by *talking about the key transformational role of forests as basis for change. Transformational change that we need in our society as basis for a sustainable future.* As basis for a, *tertium quid,* as Prof. Ciancio refers in his work.

But before talking about the future, I will start by reflecting about the past. Because history always offers valuable lenses to look at the future. In the past, our societies have already experienced profound paradigmatic transformations as the one we need now. Europe has lead many of such transformations and in fact, Italy was the epicentre of, probably, the most important of all of them as it put the basis for our *Modern era.* Such transformation, call the Renaissance, *Rinascimento*, connected Europe back to its Classical world, but, even more important, it connected Europe to its future, as the Rennaissance, resulted in a new and unprecedented confidence in humanity, and the human intellect as basis for understanding, discovering, and creating. Such new confidence in the human intellect was *the catalyst for the scientific revolution* that put the basis for modern science. *The scientific revolution, transformed the way society understood and interacted with nature and life.* A revolution that was not only possible due to the rise of humanism but also due to a key invention: the printing press. The printing press allowed for the standardization of information and the dissemination of knowledge and

[1] *Tertium quid*: unknown or indefinite thing related in some way to two known or definite things, but distinct from both.

[2] Keynote speech for opening the Academic year 2018, Italian Academy of Forest Sciences, Firenze, 21st of March, 2018.

ideas in a new scale, which was possible through the production of books that became the bricks for constructing our modern era.

The scientific revolution was experienced very closely in Florence, as Galileo Galilei, who Albert Einstein considered the father of modern science, published here his influential work on the *Dialogue Concerning the Two World Systems*. And of course a revolution in Italy cannot take place without having also its Artistic dimension; and in the hands of artists like Leonardo da Vinci, art itself became a science or we could also say that science was transformed in Art. In Italy art and science converge for the first time as adults.

Two hundred years later, and as result of the human capital accumulated since the time of the scientific revolution, Europe lead another great transformation. *The Industrial revolution*, which gave birth to a totally new era, in which we are still living today, the Industrial era. The Industrial revolution, again was catalysed by another key invention, *the steam engine*, which revolutionised the way and scale in which we could produce and manufacture products. The economic production moved from the old workshops to the new factories, which in turn required a new scale of capital and energy. This is why we started using fossil-based energy: first coal and later on oil and gas, in order to meet the needs for massive energy to manufacture products in factories. This is how *our existing fossil-based economy became the new economic paradigm.*

A fossil-based economy that in the last 200 years has resulted in unprecedented economic and population growth as well as social and technological progress. An economy that in the last three decades have experienced the greatest economic acceleration ever, resulting in a global economic convergence for the first time in history. In three decades, the global GDP and the global middle class have tripled, while poverty has moved from 40% to less than 10% of the population. But the fossil-based paradigm has another face too: *it has generated the largest environmental externalities of our history.* For the first time in history, we have changed the climate of our planet and we are crossing its resilience boundaries due to loss of biodiversity and the degradation of our land resources.

And the issue, is that in the future such environmental challenges will be more difficult to address due to population growth but especially due to an unprecedented expansion of the global middle class. By 2030 we expect 2.5 billion people more joining it. This has great implications for the demand of food, water, energy and materials (for buildings, clothing, transport, etc). Therefore, *the key defining question of our times is how to meet the increasing demands of a growing middle class and at the same time address the urgent global environmental challenges we are facing?* How to do that? The answer is that we cannot address both. At least not within the existing fossil based paradigm.

We need a new paradigm. A new economic paradigm where prosperity takes place within the renewable boundaries of our planet. Where renewable energy and renewable biological resources are the basis for a sustainable economy. *Where a bioeconomy, remember that bio means life, becomes the prosperity engine for sustainable development.*

But why a bioeconomy is so fundamental in creating a new economic paradigm?

Well, while the energy sector in the long run will be almost fully decarbonise, still we will need to produce an increasing amount of materials to meet the needs of a growing middle class in terms clothing, buildings, transport, etc. However, in order to address climate change and other environmental problems, such materials cannot come from fossil sources or non-renewable materials like concrete or steel. They will need to come predominantly from renewable biological resources. Biological resources, which are renewable, but not unlimited. This means that their use needs to be intelligent, efficient and sustainable. It also means that maintaining their resilience to climate change should be a key priority for a sustainable bioeconomy. Therefore, investing in biodiversity, which has already great intrinsic value, should be a key investment for a sustainable and resilient bioeconomy. In fact, bioeconomy and biodiversity should be seen as the two sides of the same coin as they support each other.

This is why the bioeconomy, above all, is an opportunity to address the past failure of our economy to value nature. To value our Natural Capital and recognise it as the basis for building a synergistic relationship between economy and ecology: a Tertium quid.

And the good news is that in the last decades also science and technology development has experienced a new revolution, a digital revolution triggered by the key inventions of our times the computer and then internet. The digital revolution has transformed the way we can use science and technology to understand nature and unlock value from our biological systems which was previously inaccessible. In 2003 the first human genome was sequenced, taking more than a decade and costing 2.7 billion dollars. Today a human genome can be sequenced in a few hours and for less than 1,000 dollars. That is the rate of transformation that science and technology is experiencing.

Paradoxically, the digital revolution characterised by developments like artificial intelligence, can become the catalyst for a new economic paradigm, which has life at its centre, the bioeconomy paradigm.

And to develop the bioeconomy, the *tertium quid*, resulting from a symbiosis between ecology and economy, our forests, forestry and forest-based solutions offer the greatest potential and should play a central role.

Why?

Our forests are the most important land biological infrastructure we have, not only in our continent but in our planet. Our forests are the largest terrestrial carbon sink, main terrestrial source of precipitation and oxygen and main host for biodiversity. They are key for our socio-ecological resilience as they support the sustainability of the most important resources to sustain life: water, soil and biodiversity. *Forests support life and help life adapt to change.*

But our forests play another fundamental role too. Key for the bioeconomy. *They are the most important source of non-food non-feed renewable resources. Resources that with emerging technology can be transformed into a new range of bio-based solutions that can replace and outperform fossil-based and non-renewable products.* Products from the plastics and textiles industry which will need to address a demand 3-4 times higher by 2050, or the construction sector which still needs to build 50% of the urban fabric needed by 2050. Such important demand increases will need to be accompanied by important transformations towards fossil-free and sustainable solutions. Forest bioeconomy solutions can catalyse such transformations.

Lets see three examples.

First example comes from the *textiles sector*. One of the most dynamic and also rapidly growing sectors. Nowadays, 90 M Tonnes of textile fibres are produce every year. Two materials dominate the sector: polyester (fossil based) and cotton. Polyester represents almost 70%, while cotton about 20% of the global production. Wood based fibres represent only 6% but their relevance will increase in relative and absolute terms due to three main reasons:

- First reason is that the demand for textiles is expected to increase by almost 400% by 2050 due to population increase in urban areas and the expansion of the global middle class, which results in higher per capita consumption;
- Second, the production of cotton is already stagnated and it will not be able to meet increasing demand for textile fibres. 50% of the cotton globally is produced in China and India. Such countries will need land for producing food and cotton competes with agriculture for arable land. Furthermore, cotton is water and pesticide intense. Wood based fibres can fill the cotton gap;
- The third reason, is climate change. Mitigating climate change requires moving from fossil resources to renewable solutions. New wood based fibres produced with new technologies, like Ioncell, can reduce the carbon footprint and other environmental problems related to textile fibres production.

Lets see another example coming from the controversial *plastics industry*.

The plastics industry is one of the fastest growing sectors of the last decades. In 50 years the global plastics production has increased by 20 times. In the last 10 years we have produced more plastics than in the whole 20th century together. The current production is an environmental global problem of first order. It results in almost 400 M tonnes of CO_2 and 8 M tonnes of plastic residues to the oceans every year. Is like throwing a track full of plastics to the sea every minute, putting at risk marine life and our fish food value chains. The challenge is that urbanization and the global middle class expansion are resulting in higher demand for packaging and plastics. Therefore, the case for bioplastics is clear.

However, nowadays they only represent less than 1% of all plastics production, despite the fact that technologies exist to produce different types of plastics from different biological resources. *Biobased plastics* do not only have a lower carbon footprint but also has the potential to become biodegradable. The challenge

is that bioplastics are not yet cost competitive compare to petroleum based plastics and usually a cost premium of about 30-100% needs to be added depending on the bioplastic. Such higher costs, are not only due to the lower prizes of oil compare to bio resources but specially because the value chains and operations are not yet optimised and scaled. However, very important advances are taking place and important brands like NOVAMONT are developing new biobased solutions. Furthermore, relevant sectors like the car manufacturing, have started to produce first models made of bioplastics. So there is hope for change.

The third example that I want to give, covers a larger dimension than the previous two. It addresses *the role of forests, trees and wood in transforming our future urban environments.*

First of all, let me remind you that while urban areas are home to more than half the world's population, they are responsible for 80% of the global GDP and more than two-thirds of the world's energy consumption and greenhouse gas emissions. Their importance will grow as by 2050 we expect that two-thirds of the global population will live in cities. Therefore, the future of cities need to be rethink as they need play a leading role in fighting climate change while developing sustainable infrastructures for their populations. As I mentioned before, we still need to build 50% of the urban fabric needed globally by 2050.

But the building construction sector responsible for that, is not currently environmentally friendly. In fact, it has massive impact in our environment. In Europe the use and construction of buildings is responsible for 35% of carbon emissions, 40% of energy used, 50% of all raw materials used and 30% of the waste generated. These are massive Environmental Impacts!

Such impacts are partly explained by the fact that two materials dominate the sector: concrete and steel. In fact, 70% of the embodied energy in our buildings is in these two materials, which are not environmentally friendly to produce as producing 1 Tn of steel releases an average amount of 1.7 Tns of CO_2 while producing 1 Tn of cement, a key ingredient for concrete, results in about 1 Tn of CO_2.

So How can our forests help to build sustainable cities and make them climate-smart?

First of all, our forests provide *wood, which is the only significant construction material that is renewable and can be grown sustainably*. Using wood in construction is one of the most effective carbon sequestration and capture technologies we have. Because 1m3 of wood stores 1 tn of CO_2. If we replace concrete and steel with wood, we can reduce the carbon footprint of a building by around 50% and the same time reduce the total amount of materials by the same amount too. The good news is that new technology allows us to build wood buildings as large and tall as with concrete. There are no technical limitations.

But wood is not the only thing that our forests offer. Placing trees and urban forests near buildings, can cut air conditioning use by 30%, and reduce heating energy use by 20 to 50%.

Therefore, wood, trees and forests are called to become the backbone for sustainable cities!

But not only forests inside cities provide direct benefits to urban populations. Forests outside cities for instance provide drinking water. In fact, *forests*, which after oceans are the main source of precipation, *are the main natural water infrastructures that we have, providing 75% of the world's accesible fresh water resources.*

These examples show the transformational potential of our forests in moving towards a new economic paradigm, a tertium quid*, where prosperity takes place within our planetary boundaries as result of a synergistic symbiosis between economy and ecology.* Such examples should also make us reflect on what are the implications for forest management and silviculture to ensure the sustainability of our forests and their catalyzing role, while maintaining their resilience to climate change and natural disturbances. In this context, *the role of forest management and silviculture becomes more important than ever for our society.*

Playing such role will not be an easy task. First of all, we need to engage our increasingly urbanized society with a compelling but science-informed narrative that explains the key transformational role of forests and forestry. Then we need the right policy framework. One that recognizes the "active" transformational importance of our forests and forestry. *A coherent policy framework is* necessary to provide the right incentives and attract new investments for forest management *to catalyse an urgently needed forest virtuous cycle.* A cycle build around resilient forests, a sustainable bioeconomy and good governance. Such virtuous cycle is a prerequisite for developing a sustainable and resilient bioeconomy.

In this context, I would like to congratulate the recent efforts made in Italy to develop a more coherent forest policy framework to recognize the role of sustainable forest management.

Furthermore, in order to realise such virtuous cycle the role of forest science is crucial to provide the knowledge base for forest-related policy and management. To unlock the potential of forest science, forest science also needs to go outside its comfort zone, build new partnerships across disciplines and sectors and adapt and adopt new scientific approaches and tools. Approaches that as Prof. Ciancio argues in his paper, need to help us understand and manage forests as what they are: complex organized systems, socio-ecological systems.

Some decades ago we could only provide "exact" answers to simple problems, but nowadays with the development of complexity science, the capacity to process big data and run AI algorithms, we have better tools to understand forests as complex systems and manage them according to a systemic approach as advocated by Prof. Ciancio.

Therefore, as I mentioned before, paradoxically, the digital revolution, if use wisely, can help us to understand better nature as well as to unlock the potential of biology and forestry for building the post-petroleum era.

Let me finish with a quote of Albert Einstein: *We cannot solve our problems with the same thinking we used when we created them.*

And let me add that in my view *forestry this century, the century of biology, should be a new way of thinking, a* tertium quid…