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SILVICULTURE BETWEEN PHILOSOPHY AND SCIENCE

Silviculture has been significantly revised over the past few decades. This has led to a change in the forest-man relationship, and made a deep crack in the traditional conceptions which consider the forest only as trees.

This paper takes a look at different silvicultural theories with specific emphasis on their philosophical and ethical implications.

By analyzing some important scientific currents of thought – the Newtonian concept, Neo-positivism or logical empiricism as it is also known – and the complexity of living systems, the author sheds light on the theories at the basis of classical and systemic silviculture and on how the new approach will impact man's relationship with the forest.

Key words: classical silviculture; systemic silviculture; complexity; objectification.

There is a fact that is becoming increasingly clearer, and the current debates prove it. Silviculture has been significantly revised over the past few decades. This has led to a change in the forest-man relationship. This revision affects the meaning and value we attribute to the forest. This new vision has undermined traditional conceptions which considered the forest just as a sum of trees, an outdoor factory for producing wood. In no other area of forestry sciences is such a conceptual shift more evident than in the principle of systemic silviculture

Classical silviculture, as currently taught in universities, is the theoretical and practical expression of the Newtonian concept according to which laws originate from experiments. In silviculture, therefore, everything would be deducible from data acquired through experimentation. However, if that were indeed the case we would already – and for a long time – have a precise and full knowledge of many and complex phenomena that take place within the biological forest system following cultivation events. Therefore, we would have an invariable, verifiable and reproducible science of silviculture. Furthermore, accepting this theoretical assumption would mean that the

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consequence(s) of what has been scientifically experimented would be indubitable, unchangeable and definitive.

Is all this plausible? It seems quite unlikely, especially since it conflicts with a fundamental epistemological principle: everything in science is subject to change, nothing can ever be definitive. And since “The greater our knowledge increases, the greater our ignorance unfolds”, *homo sapiens* will always be seeking truth – that is, scientific truth. This is the basic reason that he tries and will always try to go ahead in his attempts to reveal the unknown. This is the decisive thrust that leads to scientific and technological progress.

Previous essays have fully described the interpretation of the theoretical and practical significance of the new conception. Here we shall try to highlight the various scientific silvicultural theories with special attention to their philosophical and ethical implications. More specifically, we shall try to answer the following questions: 1) What does the theory behind classical silviculture assert? 2) How does that theory differ from the new conception of silviculture? 3) To what extent will this new way of thinking influence man's behaviours with regard to the forest?

One statement is needed before considering the issues regarding the first and second questions. The theoretical issues related to silviculture have a dual philosophical nature: (a) ontological, which concerns the scientific knowledge of the subject independently of its relationship with the observer-experimenter; (b) epistemological, which is inherent in the observer-researcher's relationship with the subject.

Thus, the issue concerns the relationship between experimental data and theoretical principles. So there is no doubt that insofar as living systems are concerned, experimentally acquired data do not entail a knowledge of the theoretical assumptions. The object of the scientific knowledge, in this case of the forest, does not come from observation or experimentation, but from the axiomatic postulate that comprises the basis of silviculture, and specifically of systemic silviculture.

An analysis of the forest biological system may consist of observation and a reading with a more or less accurate description, or an experiment that yields a more or less large series of data. In either case, the results remain within the context of provisional probability. If we repeat the observation or experiment we will always and in any case have a more or less reliable prediction, but never the certainty of the repeatability of the results. Therefore, we cannot deduce any axiomatic postulate concerning silviculture and even less so, knowledge of the forest from the experimental results

We can better settle the matter if we bear in mind EINSTEIN's concept according to which theories are born through speculative processes. In other

words, the process of knowledge does not go from facts to theoretical conjectures, but from the latter to facts and experimental data. EINSTEIN maintained that it is the theory which decides what we observe. Therefore, we can state that in the biological and systemic fields, objectifying scientific data is not an option for understanding the subject, in this case the forest, a complex biological system.

We have already spoken of the aspects relative to the Newtonian conception. As to the ontological issue (1) we must first say that the legacy of the reductionist and mechanistic outlook persists, mostly unwittingly, among many forestry researchers and technicians. And this, in spite of the fact that during the early decades of the last century two important currents of thought became established: *i*) in ecology the introduction of TANSLEY's concept of the ecosystem; *ii*) in philosophy of science the Neo-positivism that developed from the discussions of the Vienna Circle.

These currents of thought, that were born following the statement of the theories of relativity and quantum mechanics in physics, of non-Euclidean geometry in the formal sciences, of statistical and axiomatic methods in the empirical disciplines, led to significant changes on the philosophical and scientific as well as on the cultural, ethical and social levels.

The problems inherent in ecological research, and in particular in research on highly complex natural systems as we shall explain below, are linked to the inevitable interaction between the observer-experimenter and the subject of the experiment. This process creates a series of retroactions of the subject under examination as expected by the axiomatic postulate of ecosystems and involves the need to know the countless variables related to the multiple interactions between organisms and the environment.

Neo-positivism or logical empiricism caused a true upheaval in scientific disciplines, especially insofar as the precision of language, rationalism and the cumulative progress of science are concerned. Epistemological considerations were based upon the methodological characteristics of scientific activity that were considered absolutely constant. In addition to logical coherence and formal correctness, for the logical empiricists the so-called *factual* or *observational evidence* was essential to scientific statements. If a theory succeeded in justifying its affirmations on a factual basis it was scientific, and vice versa, it was not if its concepts could not be traced back to that base.

Therefore, according to this theory, each aspect of scientific investigation proceeds in the direction of determining the transition from factual or observational propositions to increasingly general theoretical propositions. As its first *raison d'être* this involves the objectification of the factual or observational data. This view is innovative on the philosophical, scientific and

cultural levels, but as we said earlier, it is unacceptable if applied to highly organized natural systems.

Although he was an authoritative member of the Vienna Circle, POPPER, allied himself with different positions. He supported the hypothetical deductive method: the formulation of the hypothesis is followed by an empirical check by deducing experimental facts expressed in basic statements. In brief, what leads to new theories, to new discoveries is the moment of the theoretical-hypothetical proposition before any possible experimental type of justification. Without a doubt even though it is not anchored to an organized conception of complexity, this approach is better suited to the study of natural systems and silvicultural research.

The forest belongs to “systems with organized complexity”, according to Weaver’s definition regarding dynamic natural systems, which are characterized by a considerable number of variables connected in an organic whole.

Problems posed by such systems – he maintains – are too complicated to be subjected to old XIXth century techniques which were so successful in simple problems with two, three or four variables. These new problems, furthermore, cannot be manipulated with statistical techniques used in describing the average behaviour of disorganized complexity problems. What else can be added? Nothing. Only that some silviculturists and forest ecologists should stop and think before they incautiously treat the implications of scientific and technical research.

Ever since the beginning, foresters have ideologized the cause-effect relationship. Each cause necessarily leads to an effect which, therefore, can be deduced from it. This requires linearity in research and the sublimation of deterministic mechanism. Embracing this paradigm clearly implies a teleological vision of things. The generalized acquisition of this cultural process is due to imprinting – the early learning acquired in the forestry schools – and this leads to a conditioning which in turn leads to constant and irreversible developments when faced with given situations.

With regard to living systems, we must ask ourselves whether it is plausible to ideologize the finalistic proposition, or rather, if it is not a real conceptual heresy. All we need to do is to think of CHARLES DARWIN’S theory “On the Origin of Species through Natural Selection” and the influence it had on scientific progress. According to Darwin’s theory nature has no purpose, and the species and environment evolve together in the quest for reciprocal adaptation that has never ended.

Research in classical silviculture has worked and continues to work according to the teleological principle, that is the quest for a purpose. This aprioristically presupposes the prefiguration and creation of a specific

structure of the forest and the maximization – in terms of quantity or quality – of wood production. Or, according to an aphorism that I have proposed, “the rational order of the forest, which is the aim of classical silviculture, is instead the maximum of natural disorder”.

The underlying problem, therefore, is the influence of the teleological vision on biology and specifically on silviculture. It becomes clear when the researcher, working on an experimental project, in addition to asking “how?” – and up to this point that is the rule – also asks, in epistemological terms “why?”. The answer to the latter inevitably leads to the finalistic conception that is rejected by biologists and also by the theoretical physicists of quantum mechanics.

As we have said, this diverts the majority from the following simple principles: i) modern sciences presuppose that theory is at the base of all experimental verifications concerning a given subject; ii) a theory as such always, and in any case, rests on philosophical propositions.

The scientific paradigm of classical silviculture demands that human action be *independent* of the ecosystem. This means that knowingly or not – and it is of little importance – we do not take the complexity of the forest system into due account, since it is always and in any case considered an instrumental entity. The cultivation methods are not configured in relation to the forest’s function, but linearly to pursue, and achieve, what we can define as its unnatural uniformity or, worse, its amoral standardization. This is a heresy from the ecological, ethical and social standpoints. It is therefore also unacceptable in terms of economics, culture, history and the landscape.

Concerning the epistemological aspects (b) the question that arises spontaneously is if in experimentation it is conceivable and acceptable that the researcher totally remove him- or herself from the subject to observe, which in this case is the forest.

Paraphrasing MATURANA and VARELA we can say that everything that is seen is seen by an observer. As explained above, research in systemic silviculture is based on observer-forest interaction. We must learn to read and understand the forest’s needs and put forestry knowledge in the system’s service. We can define this as a bio-economic approach that highlights the bonds between the forest systems and the three Es: Ecology, Economics, Ethics.

The scientific paradigm of systemic silviculture requires that human action be *dependent* on the ecosystem since it aims at enhancing the unevenness and dishomogeneity of the forest system which is considered an entity that has a value in and of itself. In other words, it has rights. The cultivation work is conducted on behalf of and in the interest of the system

with the goal of increasing its complexity and conserving its biodiversity.

The guiding principle is to respect the system's self-organization without predetermining the forest's structure which changes constantly following each natural or human-induced event. The changes are more or less immediately perceptible and therefore, the forest's structure can never be categorically and definitely definable as long as we do not want ecology and silviculture to become dogmatic disciplines which are incongruent with living systems, as some self-styled unlikely italian ecologist seems to think and banally asserts.

Then, regarding the question as to the extent that this new concept influences man's behaviour *vis à vis* the forest, it is important to emphasize that whether we like it or not, the modern world is systematically and partially destroying the forests with catastrophic consequences for life on earth. Even if it may seem paradoxical, forest science, together with experimental theories rooted in a mathematical logic apparatus that is not entirely suited to biological systems, has altered the traditional techniques and values associated with them and moved them to the background.

Once the above principles regarding the importance of a knowledge of the theoretical aspects and the impossibility of objectifying experimental data are assimilated, they trigger a change of mentality with respect to the old theories, not only from the scientific and technical standpoints, but also on the cultural, social and ethical levels. In other words, we cannot accept the principles of systemic silviculture without accepting the philosophical and scientific propositions which are the basis of the new mentality. This process is having difficulty in becoming established as would be useful and necessary, especially because many scholars – good, sometimes very good researchers on several and specific aspects – are the driving forces of the deterministic mechanistic theory of the “wood-producing forest”. What's more: they have made this theory into an ideology and precisely for this reason cannot liberate themselves from the constrictions that are connected to this cultural dogmatism.

But, we know that cultural constrictions are hard to eliminate. To do so we must be creative, think outside the box, eliminate those ideas that we accept uncritically and repeat systematically. Except for some sporadic cases, it is indeed difficult to find this attitude in the world of forestry research which is closely tied to the theory of a maximum, constant annual yield and the irrepressible desire to obtain the maximum income in the shortest possible time with the smallest outlays of energy, labour and capital.

According to MAX PLANCK new ideas become established only when the bearers of the old ones disappear. *Sic stantibus rebus*, what should be done? Must we renounce and abandon all innovations the way that those who are

still bound to the old ideology would like, or do we turn to the young generations who, precisely because they are young are willing to fly with the eagles? As opposed to the ideologists, the young people are better capable of interpreting the new, of experiencing and sharing it. If such a mentality, as it seems, is conquering the young, then we can indeed achieve an upheaval of the old theoretical, scientific, technical and ethical orders related to the marvellous biological system of the forest and its myriad aspects.

If they are scientifically and philosophically educated, young people perfectly realize how important and significant this radical change really is. They are both actors and spectators in a process that involves two different philosophical mentalities – of classical and systemic silviculture. In this time of momentous changes it is essential that they understand the philosophy at the basis of the new silviculture – and that is systemic silviculture.

We can be sure, the seeds of this new theory will find fertile ground in the young people. They are aware of the fact that they are living an extraordinary experience, and participating in an extremely important scientific, technical, cultural and social event. It is up to them to choose whether to move forward or remain bound to the past... with the full knowledge that in the latter case their field of professional action will become smaller and smaller until it practically disappears.

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