

Accademia Italiana di Scienze Forestali

THE FOREST AND MAN

Edited by

Orazio Ciancio



FLORENCE 1997

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On the cover: Vincent Van Gogh (1853-1890) s195v / 1962
Roots and tree-trunks (f816)
Canvas, 100×50 cm
Auvers-sur-Oise, 1890

Photograph courtesy
of the Van Gogh Museum, Amsterdam.

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INTRODUCTION

When Orazio Ciancio proposed a round table conference in which the speakers would be all the people who work on our journal, not only the very young, but also the older, more experienced members of the staff, it struck me as a wonderful idea. The title, «The Forest and Man» was and is, in my opinion, brilliant and apt. These are permanent problems for Italy, we are faced with them every day, and we do not have the right to neglect them, or even worse, forget them.

The meeting was held, and attracted a surprising number of mainly young participants. It was proof that both the subject and the moment were right.

This book contains all the papers presented at the conference. A glance at the table of contents is sufficient to see how broad and current the subjects are. I am certain that foresters will read all these pages, not only those who came to Florence, but the others as well. I hope that the volume will be successfully received by another audience, other readers. The reason behind this hope is obvious. It is only by knowing and understanding the thoughts of the Italian scientific forestry community that those who work with the land and the landscape, as well as the problems of mankind in Mediterranean and Alpine Italy will obtain a clearer picture of what is happening in our mountains, on our hillsides. They will succeed better in their work if they reflect on what they read in this book and in other recent publications about the forests. Once again they will see that humanity is in the centre of each thought, each initiative, each undertaking and enterprise. Humanity is in the centre of the ancient cities and in their

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recent, and often horrible suburbs, in the centre of well groomed, cultivated fields, so why not in the centre of the forest as well?

The Italian forests have lived through millennia, they have been used, often exploited, not infrequently degraded, sometimes improved and enhanced by mankind for its own pleasure, but mainly for profit.

In my opinion, this book makes an excellent contribution, by presenting a clear and updated picture not only to scholars and experts in the field that is daily gaining in strategic importance throughout Old Europe, but also to the humanists, the philosophers, the educated readers who are concerned about the future of their own country and of Europe.

This is why I am so pleased that this book has become a reality after the resounding success of the congress.

Florence, January 1996

Fiorenzo Mancini

PREFACE

A new way of looking at the forest does not mean that it is better than the old. But neither is it worse. To understand it, we must pay attention to it. The logic behind the subject-object concept has been analysed through the years, and from many viewpoints. Therefore, there is no need to insist on the issue. It represents a thought that philosophers, scientists and artists have been debating. It is a force of attraction that crosses through problems of morality, knowledge and art. It touches upon the principles of man's behaviour in relation to nature. And it is precisely for this reason that it is so significant and interesting. A backward glance, however, shows us that it was not always like this. The idea of man's unity with nature is ancient and for a long time it pervaded the primitive world, promoting cultural development.

The concept of the separation between man and nature is relatively recent. It led to the development of the «modern», with all its related advantages and drawbacks: it was a true cultural revolution. It caused changes in the *Weltanschauung*: man is free to do as he pleases with nature, to exploit it at his pleasure. The consequences of this way of thinking are before our eyes. Concerns for mankind's survival, in addition to being recurrent, are increasing constantly. Many fear that we have entered a vortex from which there is no exit: the problems caused by the anarchical use of technology can be mitigated and corrected through the use of new technology. For those who are driven by the fire of Prometheus Unchained, it is a virtuous circle; for those who fear that progress will become a boomerang, it is a vicious circle, a *regressus ad infinitum*.

In any event, there is a state of difficulty which in recent times is being manifested by a desire (need) to return to the past. This is not surprising: the power of the ebb and flow of history is inevitable. Hence it is not a new philosophy, only, it is brought to a higher, and more aware level. A philosophy that implies a review of mankind's behaviour in relation to nature and hence the forest. A philosophy that gives rise to a new relationship between mankind and the forest, recognising the rights of the forest and therefore, obligations to it. There is another point in this process that cannot be underestimated or neglected: today, the active participation of scientists in reposing the ethical problem is inescapable. Recently RITA LEVI MONTALCINI wrote that «On the threshold of the third millennium scientists are reaffirming their right to intervene in a field that in the past had been considered the exclusive domain of philosophers and the religious: the field of values. Their contribution to this area could go beyond the universally recognised scope of knowledge and its application in the field of inorganic and living matter».

The «new biology» is characterised by the transition from a paradigm of *control* to a paradigm of *autonomy*. In fact, according to the classic, traditional method, systems are described as heteronomous units, precisely because they are subject to external *control*. Today, however, they are considered complex units that enjoy the property of *autonomy*. That means, that they are systems with the ability of subordinating structural changes to the conservation of their own organisation. This difference is a determining factor. It imposes a different approach to the description and analysis of the systems.

But, that is not all. We must be very careful when talking about complex systems. It is a delicate issue, also because it is new and very fashionable. It must be tackled in an interdisciplinary manner, or better, in an adisciplinary manner. Just

think about the fabric of relationships that is created among biology, ecology, the theory of systems, holistic thought, the theory of information, teleology, ethics, etc. The search for the *uniformities* that govern the behaviour of complex systems is a field to be explored. The problems related to it are difficult to solve. It is a matter of defining *uniformities* with *phenomenological* features. And it is precisely for this reason that it cannot be easily deduced from the individual components of the system.

It is probable, for example that we can understand the behaviour of individual trees in a given environment, and in relation to a given phenomenon. But it is not clear why a group of trees in anastomosis with the physical environment, the herbaceous and shrub flora, and the micro and macrofauna comprises a forest. That is, a system whose overall behaviour is not assimilable to that of its countless components. The transition from the knowledge of the behaviour of the system's components to the deduction of the system's overall behaviour is both a research strategy and a challenge to be faced and resolved.

All this shows that the forest is not, nor can it be considered, a group of juxtaposed trees to analyse in parts and divisions, and to interpret according to linear schemes. The forest is a system characterised by an organisation and structure with a high content of information, a complex system comprising a large number of elements that interact with each other. The internal relationships are connected with a broader external network of relationships. The play of interactions is a continuous process, and it involves the principle of uncertainty, of indeterminateness and incompleteness, typical of everything that is complex.

Therefore, we must think of things in terms of relationships. Knowledge and experience, the abstract and the immediate are aspects of the same reality. This presupposes a sci-

entific analysis based on a new paradigm: the holistic or systemic paradigm, moving from linear to non-linear logic, from physical to systemic thought. It is a research project, the implications and developments of which are unforeseeable. The world of forestry and forests must cross the boundary that limits action to the attainment of the maximum *direct* and *indirect* utility; this often translates into gratuitous violence perpetrated on the forest, as an effect of arrogance. The term *Raubwirtschaft*, the economy of exploitation or better, plunder, renders the idea well. In the industrialised nations, the forest is no longer threatened by abuse to satisfy primary needs, it is threatened by a process that has no soul or face: a pseudoculture that knows everything about prices but nothing about values. A pseudoculture that makes the useless necessary and the superfluous indispensable.

This meeting was an opportunity to reflect upon and delve deeper into some of the many problems involved in the forestry issue. The analysis was done by foresters, who are accustomed to working in silence, and is certainly lacking in many parts. However, we believed it useful to bring the «value of the forest» to the attention of nature lovers, foresters and laymen alike. As our line of defence we have taken the formula that ERWIN SCHRODINGER wrote in 1944: «What is presumed about the man of science is that he possesses complete and in-depth, first-hand knowledge of a «few» subjects; therefore, we expect that he does not write about subjects that he has not mastered. It is a matter of *noblesse oblige*. For the current purpose, I believe it best to renounce any claims to nobility to free myself from the bonds it creates. My justification is the following. We have inherited from our ancestors an acute desire for unified knowledge that includes all that is knowable. The same name given to the highest order of schools reminds us that ever since antiquity, and for many centuries, the aspect of universality has been the only one

that was given full credit. But the growth, in breadth and depth, of the many branches of knowledge during the course of the past centuries has placed us before a strange dilemma. We clearly perceive that only now are we able to collect reliable material to bring the sum of all our knowledge together in a single whole. But, on the other hand, it has become almost impossible for a single mind to dominate more than a small specialised sector of all this. I cannot see any other way out of this dilemma (at least not without sacrificing our goal forever) other than one of us daring to attempt a summary of facts and theories, albeit with second hand and incomplete knowledge of some of them, and running the risk of becoming a laughingstock. This is my defence.»

This book contains the papers presented during the conference «Il bosco e l'uomo» held in Florence on 23 May 1995, to celebrate the fiftieth anniversary of the journal *L'Italia Forestale e Montana*. This project, sponsored by the *Accademia Italiana di Scienze Forestali*, matured among the editorial staff and the secretariat of the journal. It was a debate that was initiated by the members of the working group and was conducted with the active participation of the readers. A stimulating topic was chosen, and it is no coincidence that the forest was put first. The topic is the object of discussion in many countries and on various levels: scientific, epistemological, ethical, political, etc. The working group developed a line of thought, naturally with all the inevitable nuances and differentiations, which in many ways is revolutionary, in the scientific sense, that is. This is the reason that led us to the decision to publish all the results of the debate.

The essays here have been arranged in two sections: the *first* part deals with the relationship between the forest and mankind; the *second*, more technical part, deals with preventing forest fires. The arrangement and subdivision meet the criteria of a plan in which we tried to highlight the devel-

opment of forestry thought in relation to the problems connected with man's activities in the forest; the influence of forestry education; the importance of the ethical and economic aspects of the forest; the need for a forestry policy that takes society's new needs into account. But, as we know, all subdivisions are subjective. In this particular case, the aim is to facilitate locating points considered crucial and passages that identify specific routes. The reader can ignore this and seek out the subjects that interest him or her the most and then find the thread that connects the essays, even among the exegetic differences of the specific subjects. It is our hope to stimulate the readers to work on behalf of and in the interests of the forest which, actually, means working on behalf of and in the interests of humanity.

Florence, January 1996

Orazio Ciancio

ACKNOWLEDGEMENTS

The three papers on forest fires reprinted here through the courtesy of the Club Alpino Siciliano to whom the authors and publisher express their thanks, were presented during the conference «L'ecologia negata», organised on the occasion of the bicentennial celebration of the Botanical Gardens of the University of Palermo, on 19 May 1995.

We wish to thank the President of the Accademia Italiana di Scienze Forestali, Professor FIORENZO MANCINI and the members of the Board of the academy who made the meeting possible; Professor ERVEDO GIORDANO, Professor AUGUSTO MARINELLI, Professor RICCARDO MORANDINI and Dr. RENZO PIVI, the excellent moderators of the four sessions; and the staff of the Accademia without whose help it would not have been possible.

PREFACE TO THE ENGLISH EDITION

This is the English edition of the book *Il bosco e l'uomo*, published by the Accademia Italiana di Scienze Forestali in 1996. It was translated by STEPHANIE JOHNSON and JULIA WEISS, under the supervision of SUSANNA NOCENTINI.

The editor would like to thank the translators for their diligence and dedication.

The Italian word «uomo» as used in the title and many parts of the Italian text implies humanity as a whole. In order to best reflect the original, it has been translated as «man».

Regarding forestry technical terms, especially in the field of forest management, forest regulation and silviculture, the translators have referred, as much as possible, to the Italian version of the «*Terminology of Forest Science, Technology, Practice and Products*» edited by F.C. FORD ROBERTSON, S.A.F., Washington, 1971. (BERNETTI G., MANOLACU GREGORI M., NOCENTINI S., 1980 – *Terminologia forestale. Scienze forestali, Tecnica, Pratica e prodotti forestali. Versione italiana*. Accademia Italiana di Scienze forestali, Consiglio Nazionale delle Ricerche). When an exact translation was impossible, the translators referred to the Encyclopaedia Britannica.

O.C.

AUTHORS

Mariagrazia Agrimi

Researcher, University of Tuscia (Viterbo).

Technology constitutes a means and not an end.

Giovanni Bovio

Professor of Forest Management, University of Turin.

Whether silvicultural intervention is called for or whether the forest is left to evolve naturally, choices must be made today which derive from the analysis and the knowledge both of the cultural and silvicultural situation.

Orazio Ciancio

Professor of Forest Management, University of Florence.

What until a short time ago seemed clear, possessing an absolute precise logic, no longer responds to the needs of *scientific explanation*.

Cristiana Colpi

Professor of Forest Ecology, University of Padua.

Inevitably, the guiding principle remains the classical one, that of «imitating nature» and not just because it guarantees success but also nowadays through moral choice.

Piermaria Corona

Professor of Forest Inventory, University of Florence.

The ethical sense of silviculture lies in guiding man's action while respecting complexity.

Antonio Gabbrielli

Former Forest Service Officer. Member of the Accademia Italiana di Scienze Forestali.

For many centuries the forest has been a green mine.

Luigi Hermanin

Professor of Forest Planning, University of Florence.

The accurate silvicultural management of the regulated forests, based on operations that are periodic and scattered over the area, is an advanced model not only for Italy.

Francesco Iovino

Professor of Silviculture, University of Reggio Calabria.

Renaturalisation will entail a transformation of the forest landscape.

Vittorio Leone

Professor of Silviculture, University of Basilicata (Potenza).

The meaning of silviculture, from productive technique has gradually evolved towards management of complex ecosystems.

Giuliano Menguzzato

Professor of Forest Management, University of Reggio Calabria.

In short, if we wish to preserve the present forest landscape, it is enough to carry on with traditional silvicultural techniques, but if we wish to trigger off evolutionary processes, then we must proceed differently.

Susanna Nocentini

Researcher, University of Florence.

Forest preservation and forest conservation are two alternative forms of management and as such are rightfully part of forestry.

Paola Porcinai

Forestry Officer. Formerly Project Operations Officer in Africa, Asia and Latin America - Forestry Department - F.A.O.

The challenge at the threshold of the third millennium is stimulating and we will have to find a compromise between Utopia and the new equilibria which are to be discerned.

Luigi Portoghesi

Researcher, University of Tuscia (Viterbo).

The problem is not technical but cultural. The concept of man as an ethically autonomous subject must be overcome.

Donato Romano

Professor of Agriculture and Economic Development, University of Florence.

A theory of forest productive processes cannot help but be based on an evolutive and institutionalist outlook.

Roberto Scotti

Researcher, University of Florence.

Forest management implies planning but, if it is impossible to develop models that are effectively predictive, how is it possible to plan?

Paolo Zoni

Forestry Student, University of Florence.

Today we must change direction and the young (foresters or otherwise) should bring their weight to bear in this matter.

The forest and man

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Orazio Ciancio - Susanna Nocentini

THE FOREST AND MAN:
THE EVOLUTION OF FORESTRY THOUGHT
FROM MODERN HUMANISM
TO THE CULTURE OF COMPLEXITY.
SYSTEMIC SILVICULTURE AND MANAGEMENT
ON NATURAL BASES

The authors have contributed equally to this paper.

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*But the miserly glory of the world,
twisted memory of seasons past,
remains but the forest.*

Andrea Zanzotto

1 – *Foreword*

The forest and man, a never-ending story. For better or for worse, it is the story of mankind, of its relationship with the forest, and in more general terms, of its attitude towards nature. Through the millennia the forest has been a symbol of mystery and of a harsh, wild landscape; a place of refuge and of worship; a protective entity and a biological filter; a source of knowledge and irreplaceable resource. The pattern of this history is emblematic: doing and undoing which, in reality is more of an undoing rather than a doing. In temperate climates the primitive forests no longer exist. The few remnants that have survived are, in one way or another, being continuously misused and damaged at unacceptable rates.

The story repeats itself on the global level, and what's more, the phenomenon is worsening. Deforestation is increasing geometrically, and reforestation is proceeding at an infinitely slow rate. How much longer will the remaining virgin forests remain undisturbed and uncut?

FRANÇOIS R. CHATEAUBRIAND's aphorism renders the idea well: «*Les forêts précèdent les peuples, les déserts les suivent*» (forests come before people, and deserts follow them).

We must say that, at the threshold of the third millennium it is depressing to see how we persevere so greatly in undoing, and so little in doing. Certainly, as we will see below, it is a problem of knowledge and of culture.

Notwithstanding the fact that on the international level, the public at large has become increasingly interested in the issue, in the past few decades there have been no substantial changes in silviculture and forest management. In some areas the forest is considered a mine to be exploited, its «ore» extracted at a fast, almost dizzying rate, and to the greatest possible extent. In those regions exploitation, which often leads to irreversible degradation, is the rule, and it goes far beyond the limits of real need. Wood cutting follows criteria based purely on speculation. Use crosses over to misuse. Progress in forest science, improved technical knowledge and increased media attention to the environment and related issues have not led to and do not lead to the expected or desired effects. The forest continues to be «humiliated and offended».

GIAMBATTISTA VICO's maxim, «*L'ordine delle cose umane procedette: che prima furono le selve, dopo i tuguri, quindi i villaggi, appresso le città, finalmente le accademie*» (the order of human things proceeded thus: first came the forests, then the hovels, the villages, the cities and finally the academies) should make us stop and think.

It may seem paradoxical, but even today some scholars, and authoritative ones at that, define «harvesting silviculture» – *sylviculture de cueillete* (SCHÜTZ, 1991) as the indiscriminate harvesting of wood, even when the severely damaged, if not destroyed, forest is not even reconstituted. This approach, based exclusively on harvesting wood has nothing to do with forest cultivation, but much to do with business.

And it can not be related to the term silviculture which, even if used with the word «harvesting», has a totally different meaning. If we truly want to identify and define it, we must clearly state that that method of working in the forest is nothing other than pure, outright plunder.

2 – The importance of the forestry tradition

In regions where forestry tradition carries some weight, the advantages of revising the guidelines of forest management are under serious consideration. However, if we exclude many Alpine valleys and small areas in Central Europe, forest management is following a firm and well-defined path: maximising soil rent. In other words, in technologically advanced countries, in spite of good intentions and many statements, we are still far from taking into due consideration the needs of the forest, a complex biological system indispensable for the continuation of life on this planet.

However, if we look a little further, we can see the need to embark on new paths.

ROBERT HARRISON (1992) keenly remarked that when cities becomes menacing, forests become innocent, pastoral, recreational, amusing.

We must change our attitudes with respect to the forest. We must make radical changes in the scientific approach. If we cannot totally eliminate it, we must reduce the gap between the outlooks of the scientific community and those of post-industrial society. We must resume the forest management debate on a new basis; otherwise, we will end up governing the past: transcribing or repeating what has been acquired in environmental conditions and socio-economic situations that differ from the current ones. And, the price is always paid by the forest.

The reluctance to change what we see in the forestry world contrasts markedly with the speed of changes taking place in society. Socio-economic and cultural changes impose an equally rapid change in forest management. Society is insisting on greater attention to the forest. And foresters must take this into account or risk negating their own professionalism. However, we must admit that all this is much easier to say than to do. And, in any event it must be filtered through research and the development of appropriate techniques. It is certainly a difficult transition. Experimentation in forestry requires forest time spans, and this complicates matters enormously.

LANIER (1986) wrote that:

Innovation always makes the forest professional hesitate. This position often appears contrary to modernism and maintains a reputation for antiquated conservatism which, when it recognises the rapid obsolescence of new goals and fashions, will even console the «forestry sage», the conservative par excellence, who has learned to work with time.

LANIER's is a view and interpretation of modernity and technical-scientific progress that can be shared or not. However, one thing is indisputable: by their nature and training, foresters are reluctant to change. A proof of this? The driving idea that has always sustained their activity is that of acting in accordance with tradition. Whoever proposes change is often accused of being an ideologue, an absolutist, a dogmatist, and even a fundamentalist. As we will explain more fully below, the cases of BERNARD LORENTZ, ADOLPHE GURNAUD, and ALFRED MÖLLER, just to mention the most outstanding ones, are proof of this.

Until just a few years ago the forester was unanimously considered the expert in forest management. His scientific, technical and cultural contributions were beyond dispute. He was responsible for making decisions on protecting the forest and on guaranteeing the continuity of its cultivation. His sug-

gestions or actions regarding conservation and production were never analysed, nor were they subjected to criticism. In recent years, however, other professionals have been usurping the right to determine if, how, and why the forest should be managed. Furthermore, they generally give approximate and superficial guidelines which are almost always inadequate with regard to the forest's real needs. And yet, this phenomenon has been supported by associations, public authorities, academic institutions, etc.

Foresters, accustomed as they are to working in silence have had neither the desire nor the power to assert their achievements in the field, and the knowledge acquired through their studies, research and experiments. This is a grave error, but there is more: they have not made any effort to arrest or even to modify this state of things. This situation has led to a series of political, administrative and technical problems, the repercussions of which must be analysed and interpreted objectively in order that they may be fully understood.

In this sense, it is worthwhile to present a few considerations and proposals which, if accepted and applied, could interrupt the spiral into which foresters have recently plunged. They are historical and cultural considerations, and theoretical and practical proposals which should lead to a change not only in the meaning of silviculture but also in the cultivation approach itself. The forester today must learn how to re-present himself, exploiting his professional skills to the utmost level. In practice this means a continuous effort to achieve the functional efficiency of the forest system.

3 – *The historical-cultural background*

For a very long time, the forest gave mankind what it needed to live and to survive: it was both a *reserve* and a

resource. First it was a shelter and a source of wood, as well as fruits, mushrooms, honey, etc., then it became a hunting reserve, and finally, a pasture. And yet, according to GENEROSO PATRONE (1981) it is still a «little known remnant of the protocosmos». It is an unknown world: it conceals enigmas that man tries to reveal and categorise. However, this laudable and difficult intent is offset by a perverse desire to destroy. And since the motivations, the «interests» of a select few, are well known, everything is done to overlook, diminish or even hide the effects of the destruction of vast forests. Furthermore, we must add that the attempts at recreating damaged or transformed forests are of little use when we have the means at hand to annihilate hundreds or even thousands of hectares in a short time. This is not facile alarmism, it is a fact that we must bear in mind, whether we like it or not.

Regarding the concept of the forest as a *reserve* or *resource* and the apparently definitive establishment of the concept of the forest as a resource, HARRISON (1992) has provided a strongly critical review of LE ROY's view of the forest (under the heading «*Forêt*» in *La Grande Encyclopédie* by DIDEROT and D'ALEMBERT). In his analysis he contrasts this view with the idea that in England MANWOOD maintained in his treatise on forest laws, dated 1592. We must note that in recent decades, albeit with difficulty and delay, we are moving in the other direction, that is: the forest is being considered more of a reserve and less of a resource.

For LE ROY, HARRISON writes, the forest is a vast wooded territory, distinct from the areas that are more restrictively called woods (*bois*). This definition differs markedly from MANWOOD's, for whom the forest was a juridical or legal domain to which access was prohibited by royal decree since it was destined for the pleasure and enjoyment of the king. For MANWOOD a forest consisted of four elements: vegetation and game, special laws and officials. In LE ROY's technical

definition the forest is reduced to «vegetation»-greenery. The forest is nothing more than an agglomeration of trees. For MANWOOD a forest was essentially a refuge from humanity, a place of asylum where wild animals could live safely under the protection of the king. It had nothing to do with public interest or utility. On the contrary, the forests represented the boundaries of man's exploitation of nature. LE ROY never spoke of animals. *The forests as habitats had disappeared*. If the habitat was not an interesting subject for LE ROY, it is because the forest had already been conceived in terms of lumber. Lumber, in turn, was conceived in terms of its useful value. And useful value was related to the concept of «rights», the rights of state, the rights of private ownership, and the rights of posterity. Nowhere did he mention the rights of wild animals that live in the forest. In contrast, MANWOOD's definition of the forest was based precisely on what he considered the rights of animals of pleasure, guaranteed by and inseparable from the divine rights of the kings themselves.

The forest as a habitat, and then, the rights of animals. So, why not include the rights of plants? This important and significant aspect is found in ITALO CALVINO's novel *Il barone rampante* set in the XVIII century. A reading of *Il barone rampante* reveals the exegesis CALVINO attributes to the Enlightenment. It is an original interpretation that describes a *Weltanschauung*, a philosophy of life or world outlook which differs from the more accredited one, at least in the general opinion.

The novel, HARRISON says, contains a poetic criticism of Enlightenment humanistic idealism. CALVINO's baron, Cosimo, spent his life in the trees. He acquired fame among the *philosophes* (Voltaire, Diderot, etc.) for certain «politically correct» treatises he wrote on subjects such as republican constitutions and social contracts. But one of these, entitled «*Progetto di Costituzione per Città Repubblicana con Dichiarazione dei Diritti degli Uomini, delle Donne, dei Bambini,*

degli Animali Domestici e Selvatici, compresi Uccelli Pesci e Insetti, e delle Piante sia d'Alto Fusto sia Ortaggi ed Erbe» [Outline of a constitution for republican cities with a declaration of the rights of men, women, children, domestic and wild animals including birds, fish and insects and plants be they trees, vegetables or grasses] was ignored. And yet, it was a beautiful work that could have helped all governments; instead no one took it into consideration and it remained unheeded. Cosimo's treatise was ignored because his contemporaries were only interested in the declaration of the rights of man – the rights of human subjects and not of nature's species and objects. According to HARRISON, today we are witness to the consequences of these unilateral declarations of the rights of a single species, neglectful of the natural rights of all the other species. In this sense Cosimo's treatise was ahead of its time – and even ours with respect to this issue.

Can we but not agree? Is there anything to add? Any comment would be redundant and therefore useless. However, there is one thing to emphasise. Poets, artists, and men and women of letters, especially of CALVINO's calibre, are always trailblazers: they generate culture. Technicians need only take heed; they must give practical content and form to those intuitions and syntheses, especially if they are elegant and harmonious.

Through the years we have witnessed a continuous succession of events which, to say the least, were a menace to the survival and function of the forest. The too few periods of stasis alternated with periods of excessive use. How can we forget the deforestation that occurred in the Mediterranean region and England during the XI and XII centuries? And there is more: in Europe those actions were associated with the extermination of wild animals that were commonly defined as not useful. Earlier we have said that for long peri-

ods the forest was the source of subsistence and protection; but it was also a reservoir of raw material for building ships, indispensable for dominating the seas and expanding trade. Through the ages the forest has been considered a source of direct utility: energy, soil conservation, industry, etc., and of indirect utility: aesthetic pleasure, water purification, CO₂ accumulation, etc.

Hence the importance of the forest. The rise and decline of the Republic of Venice also depended on the availability of timber, mainly oak. At the end of the XV century, a large part of the Republic's forests were exhausted from intensive utilisation, and as always under similar circumstances when wood needed for industry became scarce, a series of measures were implemented to protect what remained of the ancient forests. But it was too late: in Europe the shipyards had been moved north, and the merchant marine, the pride of the Republic, lost much of its vitality. In short: the forest marked the splendour and decline of the Republic of Venice. First it permitted its birth, then it helped its growth, and finally came the twilight of its industrial development.

Even in England the rise of the shipbuilding and steel industries was linked to the destruction of forests. The disappearance of vast tracts of forests that occurred starting in the XI century did not have the slightest influence on forestry policy, in spite of JOHN MANWOOD's treatise that was published in 1592. It was only in the XVII century, following studies and surveys by JOHN EVELYN (1662) that the importance of wood for industrial development and the gravity of the economic impact caused by the destruction of the forests was understood.

Albeit to a different extent and at different rates, similar situations arose in Germany and France during the XVII and XVIII centuries. The use and often abuse of the forests can be attributed to the spectacular growth of the steel,

glass, paper, building and other industries. Man's desire to dominate and bend nature to his ends is written in these events, and today we can easily read, interpret and understand them.

All of this is well known. There is nothing new. However, here we will examine certain problems from a different angle. In the first place, there is the influence of modern humanism on the development of forest science. Secondly, the evolution of forestry thought followed by the developments of silviculture, of yield regulation and of forest economics with the concurrent passage from the moment of empiricism to that of science or of natural sciences, specifically, biology and ecology. And finally, there is the impact of socio-economic development and the culture of complexity on our way of looking at and seeing the forest.

4 – Modern humanism and the progress of forest science

«Modernity» has represented and still represents an era to which all of us, more or less knowingly are culturally tied, and from which it is difficult to detach ourselves without suffering varying degrees of trauma. The word «modernity» is often used in an indefinite manner. This is due to the objective difficulty involved in finding an appropriate definition. The concept of modern lends itself to various interpretations, but nearly all of them in one way or the other, touch upon and are influenced by the thoughts of three metascientists: GALILEO GALILEI, FRANCIS BACON and RENÉ DESCARTES. And it is precisely for this reason that we realise how important the role of science was and is. Furthermore, we must say that starting in the nineteen seventies bitter debates, with as yet uncertain results, have arisen regarding the exegesis of the role of science in contemporary society. But what do we

actually mean by «modernity»? Perhaps we must give an introductory definition.

GIDDENS (1990) maintains that modernity refers to customs and social organisation that emerged in Europe starting from approximately the XVIIth century.

For HARRISON (1992) what distinguishes the era of man from all previous eras, is the humanistic ideology that accompanies the strengthening of his means and ambitions. Never before had an ideology so clearly separated the human species from animals, considering the entire earth as the natural wealth of the former. HARRISON prefers the term «era of man» over modernity, and the reason is clear: the concept of modernity refers strictly to cultural history, while the term «era of man» alludes on the one hand to VICO's «era of men» and on the other to the humanistic reawakening of the Italian Renaissance which gave rise to the modern era as such.

Faith in humanism, however, is sublimated in DIDEROT who believed that:

man is the sole and only boundary from which all must depart and to which all must return.

In any event, one thing is undeniable. The Enlightenment began with DESCARTES, and with the extraordinary development of modern science and technology. First the search for, and then the construction of the design of an objective science plays a crucial role: it leads to the emancipation of man through his domination of nature. In brief: nature can and must be rationally ordered and controlled. And if it is true that for some the separation between man and nature as put forth by the author of the *Discourse de la méthode* is the cause of modern confusion, it is just as true that this separation made possible a release from an even worse empiricism, yielding the exciting results that have not been fully evaluated even today.

According to PATRICK ROMANELL (1969), after DESCARTES:

The scientific method became *rational observation* that is, neither reason nor experience *alone*. Understanding nature *sub specie scientiae* means rendering it intelligible in terms of discoverable «laws» that «govern» our changing world.

In brief:

[...] the scientific method is the continuous commitment to basing conclusions on evidence.

In other words, it is a means for testing the validity of various hypotheses in a given field of study.

But, how can we fit forest science into this new context? In the field of forestry this concept has been sublimated by the German school. Even after many years this is still the dominant position as unequivocally demonstrated by the authoritative words of GENEROSO PATRONE, President of the Italian Academy of Forest Science (1980):

Man can, or rather must control nature by acting wisely and prudently in order to obtain increasingly more goods, and more and efficient services that he deems necessary for himself. In this regard, Professor Guinier, for many years director of the prestigious school at Nancy maintains that *the forest must be adapted to the needs of mankind; in some way it must be tamed and cultivated to leave room for woodland*.

ORAZIO CIANCIO (1994b) gives an epistemological explanation, so to speak, and places the forestry issue in the context of the evolution of thought that occurred through the acquisition of new scientific knowledge:

At the beginning of the twentieth century, on the wave of new acquisitions in biology and economics, silviculture and forest regulation took on a new dimension: the change was made from the empirical to the scientific concept. The principles of the economy of nature – which is what the economists of the period called the budding science of ecology – along with those of comparative phytogeography, phytosociology, and climatic and pedologic analogies were taken as the basis for the study of the silviculture and management of the forest. In those years of profound innovation, researchers enthusiastically embarked upon developing technical-economic

methods suitable for translating the concepts of this new way of viewing the forest into practice. As customary in the scientific field, this change led to the fragmentation of knowledge, much room was left for technicism and specialists. Technical analysis was considered the cornerstone for the development of the sector. Specialisation became the goal of nearly all the researchers. Research was oriented towards field experimentation. The atomistic approach, that is breaking down subjects into parts and components, allowed forestry research to achieve effective results on the technical level. But at the same time, it encapsulated forestry knowledge; it slowed down the evolution of thought; it compressed theoretical research. And there is more. It enfeebled interest in the *culture* of the forest.

Only few foresters acknowledged this new reality, and coherently tried to develop an alternative research program. However, current knowledge did not allow them to make the quality leap needed to reorient forestry thought: the times were not yet ripe.

The affirmation of the holistic view and ecological thought have made it possible to see the forest not as an agglomeration of trees, but rather as a whole, that is a system in which each component – biotic and abiotic – has a definite meaning and plays a specific role.

The philosophic concept of holism is the child of JAN CRISTIAN SMUTS, general and Prime Minister of South Africa, who in 1926 presented his ideas on the matter. A few years earlier (1916) on the other hand, FREDERIC E. CLEMENTS in the United States had defined the units of nature that he considered organic, and with a natural cycle similar to that of a human being as superorganisms. The sequences of vegetation provided proof that the biotic community behaved like a complex organism. In other words, nature could be considered as a group of interactive systems. The concepts of *holism* and *organism* led to attention being concentrated on the whole, overturning the scientific structure of analytic studies based on chemistry and physics. In forestry the most authoritative spokesman for this position was ALFRED MÖLLER. However,

his theory, as we shall see below was not successful, in fact, it was harshly criticised.

What we are confronting here is certainly a difficult conceptual passage. It is a research project which raises doubts about the scientific method itself: on the one hand its fragmentary features, albeit within the methodological structure typical of modern humanism, are highlighted; on the other hand modernity is contested, and there is a trend towards the so-called postmodern, sometimes in a confused manner, at others in an elitist manner. All this leads to the basic consideration that we are living in a period of transition. To put it better, the transition is already post-modern. And as always in such cases, the contrasts become more evident – especially in a world such as that of the forests where, as we have shown, tradition has a weight of its own, and where the dimensions of time and space have a significant impact. However, this is positive because technical-scientific progress is achieved by comparing ideas.

5 – The evolution of forestry thought

An original and as objective as possible approach to the evolution of forestry thought and technique allows an understanding of the changes that have taken place in the physiognomy, composition and structure of the forest. Furthermore, it makes possible an unprejudiced examination of the common denominator of forest management, and an appropriate evaluation of the influence of theory on practice, that is, on the methods of forest cultivation. Often the gap between theory and practice, and between thought and technique have led to heated disputes that have later proved futile and counter productive. Clarifying some of these points is the *sine qua non* for interpreting the current status of forestry. It is the

indispensable requisite for any attempt at planning the future of forestry, aimed increasingly at preserving, conserving, protecting, and renaturalising the forest.

Regarding the importance and need for a close bond between theory and practice in silviculture – a problem often seen as a millstone blocking the road to progress in forest science – in the preface to the first edition of the famous *Cours élémentaire de culture des bois* (1837), PARADE wrote the following, extremely up-to-date, statements:

In any event, those expecting to find in this book rules of conduct for all the cases that the forests can present, will be disappointed. There is not and there never will be a book that can dispense the forester from [his duty] of being a careful and intelligent observer of nature. What we can do in an elementary book is present the principal factors that comprise the science clearly and accurately, assess them and group them precisely, and finally reach prudent conclusions. When theory is conceived with such a spirit it truly becomes the basis and useful auxiliary of practice, far from being, as sometimes assumed, its rival. Deprived of theory, practice in forest cultivation, as in all other fields, cannot be other than a more or less uncertain, obscure routine; in the same way, without experience and a certain practice in material operations, the best defined theory can lead to the gravest errors. Therefore, it is reasoned practice, or the intimate bond between practice and theory that make up the truly educated forester.

The evolution of forestry thought and the forester's role emerge from a review of the paths that have been followed through the years. In the prescholastic period forest management was based on edicts, regulations, decrees, laws and ordinances – such as the famous «*Sur le fait des Eaux et Forêts*» issued in 1699 by Louis XIV, the Sun King, and better known as COLBERT's ordinance. The aim was to affirm two basic principles: one, that the forest is a public asset, and as such must be protected and defended, and two, to define and set a limitation on cutting.

LANIER (1986) says that COLBERT's ordinance is:

the first complete «charter» that establishes the major guidelines of forest policy [...] concerning waters and forests. The fundamental role of

the forest is recognised: it serves for the *needs of war, as an ornament of peace, and for incrementing trade*. In fact, it serves for everything, and it was the acknowledgement of its irreplaceable nature that established the rules for its conservation and protection. This awareness of the «forest fact» based on the symbiotic relationship between man and the forest, which is now evident to the majority of our contemporaries in developed nations, only originated among the foresighted; it took a long time to become accepted and suffered many relapses into past ways, with catastrophic effects each time. It is only three centuries old, and does not seem to have been introduced in most countries of the world.

The concern with conserving the forest, the need to halt its exploitation and regulate its use in such a manner as to obtain an annual income have led to the birth of forestry schools. With these schools, silviculture, yield regulation and forest economics, in brief, forest management, was developed. That is to say, the methods for cultivating forests, the criteria for ascertaining which products to harvest, and the methods for the economic evaluation of all the technical and administrative procedures were defined.

The scholastic period was characterised by the spread of theoretical and practical studies. Silvicultural, planning and econometric models were developed. The reduction of the forest to utility, in analogy with intensive farming models, was the guideline of the German school. The road was mapped out by JOHANN HEINRICH COTTA and GEORG LUDWIG HARTWIG – unanimously acknowledged as the founders of forestry science – *Forstwissenschaft*. COTTA organised the Tharandt school in Saxony (1785) and HARTIG that of Münden in Hesse (1789). Forty years later, in France, BERNARD LORENTZ (a friend of HARTIG's) established the School of Nancy in 1824. He and his successor, ADOLPHE PARADE, one of COTTA's former pupils, made a significant contribution to developing rational and orderly silviculture and forest management.

The creation of the forestry schools led to extensive silviculture being replaced by intensive silviculture. From *free*

silviculture based on felling wood in a scattered way over large areas, a shift was made to *regulated silviculture* based on clear felling or on the uniform shelterwood system. This concept took hold through the years, and is still supported by many authoritative scholars.

In conflict with LEIBUNDGUT's idea of *Femelschlag* (1946), especially with regard to the freedom of action that the system allows in the cultivation and education of the stand, ALESSANDRO DE PHILIPPIS (1950) maintained the need for creating order in the silvicultural treatment of high forests:

Order must begin with the choice of the silvicultural system, it must continue with the *effective application* of a definite felling plan and the observation of unequivocal cultivation prescriptions.

He concluded by saying that:

[...] we want to affirm that our silviculture, particularly that of our high forests, requires mainly order, because up to now it has been even too liberal in spite of the apparently severe limitations. The need for regulation is clear. The rules may vary from case to case, but they must take into account few, fundamental technical and silvicultural canons.

The supporters of *free silviculture* were few, and it is also for this reason that they had little say in matters.

ALBERTO COTTA (1943), former director of the school of Val-lombrosa observed that:

Clear felling quickly led to the need for artificial regeneration, and since this was a quite difficult operation, because no former experience was available in this field, silviculture found it easiest to turn to agriculture to learn the art of sowing and planting trees, an art that agriculture had known for centuries. Thus silviculture acquired the practice of arranging young plants symmetrically, of using well developed trees, so as to bring them to maturity as quickly as possible, of limiting planting to species that grew quickly and could yield more valuable timber. This was considered a transition from a primitive form of silviculture to another, regulated, progressive and more profitable form.

In Germany, forest composition changed from mixed to pure – on better soil oak and beech were replaced by spruce,

the so-called tree of riches, and on poorer land, Scots pine was planted. The uneven-aged structure became even-aged, homogenous and uniform. The physiognomy of the forest changed radically, and in consideration of the long forest times, it was changed definitely and irreversibly in a relatively short period.

To many it may seem paradoxical, or better, heretical, but actually, it is neither. It is a fact: *the birth of the forestry schools and the spread of forest science caused the disappearance of the last remnants of the primeval forest*. Under the impetus of ideas propagated by the schools and the resulting cultivation approach, natural forests were replaced by geometrically arranged monospecific plantations. The objective of forest management was the pursuit of «normality». The forest was built and ordered to supply a high yield of wood.

Mathematics and geometry made it possible to prove the full reliability of this method, as well as the importance and validity of forest science. In this way the philosophy of RENÉ DESCARTES triumphed: forest management was now based on the scientific method. In this way, what had always been heterogeneous became homogenous, what had appeared disorderly and chaotic was forced into order. There is no doubt, the will and desire to dominate and possess nature was satisfied. This materialised into a macroscopic error, the consequences of which we are still paying for today, not too many years later.

In 1952 ALBERTO COTTA wrote that:

Man [...] believed himself to be the master of the universe; he believed that it was created solely for his needs: he replaced Nature's laws with his own-economic laws based on gain, without considering that these lose all their value when they infringe on the former. He needed wood from a certain species, so he went into the forest and took it all, to the last log, without bothering about the fact that he was altering the organisation of that delicate association. The forest reacted by refusing to renew itself natural-

ly, so then man decided to clear cut and plant a new forest of a single, and naturally the most profitable species (economic law), Nature then took her revenge: snow and wind ravaged the forest, and then came the plant and animal parasites to deal the final blow. It was a painful, but useful lesson, since it revealed the need to go back to Nature.

SUSMEL (1980) interprets the phenomenon, revealing for the first time an extremely important social and cultural aspect: the Enlightenment's influences on the development of forestry technique, science and thought.

The superficiality of the artificial approach, child of «rationalism», born with the first industrial revolution and woven into the agricultural mentality, does not always seem to be rewarded by technical, management and economic benefits. It is an approach that can have a high price: the price of the precariousness of the object itself and of the goals of cultivation, even at the cost of massive and beyond certain limits, impossible energetic and economic supports.

In the agricultural, that is artificial, monospecific and monofunctional forest, created and planned to yield a maximum, constant annual product, visible wounds have been and continue to be opened, and they can only be healed with new, massive, artificial measures. In the meantime however, the soil has been impoverished. Pollution strongly impacts the life of the forest and forestry activities. Labour costs are rising at a dizzying rate. Income is decreasing and artificial reconstitution of the forest requires increasing amounts of energy, labour and capital.

If it is true, and it is, that this is indeed the state of things, ALBERTO COTTA (1943) very aptly observed that:

The artificial forest is nothing more than the quid simile of farm crops that exploit the land rather than improving it.

And SUSMEL (1980) emphasises that:

The more the level of autotrophes is altered and the other levels are brought to the point of extinction, that is, the more the ecosystem's naturalness is demolished, the more functionality and stability are diminished, and the more man is forced to increase the intensity of his actions to sus-

tain or rebalance them (SUSMEL, 1971). While the expenditure of energy and materials rises and at a certain point, for reasons of cost, of raw materials and manpower, reaches unsurpassable limits, the economic and ecological risks related to the intensification of cultivation increase geometrically. This *impasse* is exemplified in silviculture, by the artificial system, virtually reduced, as in farming, to two levels. There are autotrophes with a single species in the tree stratum and few species with irrelevant biomasses in the shrub-herbaceous stratum; and there is the soil, always with variously altered bioreducers. A typical example: the pure conifer stands created by planting preceded by preparing the ground and related practices, stands that require clear cutting and artificial regeneration.

All this should suffice. However, it may be wise to add – and this is not an insignificant fact – that, with few exceptions, artificial forests nowadays are not even profitable.

6 – *The German school and the French school*

Two were the schools at the forefront, the German and the French. Two were the concepts that developed and contributed to the foundation and progress of forest science. The German school distinguished itself in the field of planning and economics. Silviculture and yield regulations were based on rigid *rules*; the so-called *felling keys* schematised cutting arrangements and created artificial, contrived, pure forests.

The forestry expert – the *Forstgeometer* – had to measure the boundaries of the forests, estimate the volume of the stands, and appraise wood quality. Topography, stereometry and xylology were consecrated as sciences. These experts had the task of planning so as to render forest management economically acceptable.

Moderate thinnings from below anticipated the harvest of that part of the stand which otherwise would have been eliminated naturally. This type of management was based on a vision that today would be defined as «bookkeeperish». The

basic concept was linked to rigid geometric schemes and to the notion of normal growing stock, calculated with yield tables. In essence, the German school theorised the financial rotation and defined «forestry statics».

According to ENDRES (1911) professor at the Karlsruhe school:

Forestry statics is the science of calculating the product and costs of forest management. It reveals the economic moment of production and it makes it possible to recognise, among many technically feasible economic modes, those which, for either short or long periods, offer the greater positive difference in yield in relation to costs.

The French school, on the other hand, distinguished itself by a prudent and moderately conservative silviculture based on a study of methods and techniques for converting coppices and transforming stands. The conversion of coppices into high forests conflicted with the policies of the Water and Forest Authority, as well as with the interests of those who used wood from coppices in industry. LORENTZ strenuously supported the need to proceed along those lines, and in a famous letter (BLAIS, 1936) he wrote: *Je suis ennemi né du taillis dont le système a tenu les forestiers de France à berceau*», – I am the born enemy of coppice, the system that nurtured the French foresters. He was considered a dogmatic ideologue and inflexible theoretician. Accused of damaging the interests of private parties, in 1830 he was appointed administrator of the forests. That is to say: *promoveatur ut amoveatur*.

TASSY (1866) commented that:

LORENTZ was too farsighted not to understand that he was risking his position by resisting the cultural trends that an ill-conceived interest in the fiscal aspects wanted to have prevail in forest management.

There is more: he was forced into early retirement from his position as director of the forest management service in 1839.

When LORENTZ requested an explanation, the minister of finance replied quite clearly (BLAIS, 1936):

I wish to inform you, Sir, that the Administration renders justice to your long and honourable service and it was led to deprive itself of your enlightened council because of the fact that your ideas, that were too exclusive in terms of forest regulation, seemed contrary to the interests, better understood, of the service of which you were in charge.

TASSY noted that:

This decision produced a profound and unpleasant sensation in the departments.

The French school, as we have said, was also committed on another front: the gradual transformation of uneven-aged forests into even aged forests. This required high rotations and silvicultural systems based on natural regeneration. The principle expounded by LORENTZ and PARADE: «*Production soutenue, régénération naturelle et amélioration progressive*» (sustained yield, natural regeneration and progressive improvement) best summarised the guiding idea.

This theoretical and practical approach was vigorously opposed by Adolphe Gurnaud (1884) who proposed a new method of forest management ⁽¹⁾. Because of the consistency and intransigence with which he maintained his ideas, the forest Administration forced Gurnaud to leave his post. He refused to impose a certain *order* on the forest, the order which was the skeleton that supported the silvicultural concept of the artificial forest.

Regarding the imposition of a compulsory order on the forest, BLAIS (1936) observed that:

In this regard some shrewd spirits cannot but manifest a certain diffi-

(1) GURNAUD's control method and its scientific implications have been reviewed in a paper by CIANCIO and NOCENTINI (1994a) which also contains technical details and possibilities for application.

culty, they feel nature too constricted, man too tyrannical, they doubt that such a perfect method can be definitive. It does not allow the tree, or the forest to develop to full potential.

In addition to bringing back into question the composition, structure and arrangement of the forest, favouring mixed and uneven-aged stands, which even PARADE agreed were valid at least as far as mountain forests were concerned, ADOLPHE GURNAUD's presentation (1884; 1886) of *La Méthode du contrôle* – *The Method of Control* – represented a true revolution.

According to PATRONE (1979):

Forest regulation in brief, was essentially overturned. For GURNAUD and BIOLLEY it was no longer a *preliminary budget* that restricted and programmed silviculture, but rather a *balance sheet* that verified the results. *Regulation based on rules* was offset by *regulation based on inquiry*, that is the method of control. And thus, the theories of the selection forest and the control method form a single whole.

In other words, and without metaphors, regulation focused on predetermination of the prescribed cut was replaced by regulation based on verification of the yield. Thus, the terms of the problem were inverted, and it is no coincidence that GENEROSO PATRONE (1972), arguing vigorously with this position, defined the «controllists» (the supporters of the method of control) as the degenerate offspring of yield regulation. As always in such cases, GURNAUD was considered an intolerant and dogmatic technician, but time has shown that he was a theoretician and precursor of a new way of conceiving forest management.

For uneven-aged forests the French school theorised the determination of the *norm*. Studies by FRANÇOIS DE LIOCOURT (1898), SCHAEFFER, GAZIN and D'ALVERNAY (1930) on fir-stands, by SCHAEFFER (1931) on methods of calculating the prescribed cut in uneven-aged stands, and in general, by HUFFEL (1926), allowed a reconsideration of selection forests and of the selection system (*jardinage cultural*) from the wood production

standpoint. Nor should we forget that GURNAUD's and BLOLEY's selection forest takes financial and economic aspects into utmost consideration. In brief, the French school was qualified, mainly through the merits of BAGNERIS (1878) and BROILLARD (1881) for a flexible cultivation approach, for the definition of «thinnings from above» in broad-leaved stands, and for greater attention to the natural evolution of the forest.

One feature, however, was shared by both of these schools – to obtain maximum soil rent. This objective remained and still remains unchanged; it has dominated and continues to dominate. We must say it clearly: even today there is agreement on the need to obtain high profit from the forest. It is certainly a legitimate aspiration, but not a viable one. We must convince ourselves that silviculture is a high cost, and low profit business. This is a reality from which there is no escape.

These two concepts (the German and the French) were radically modified over the years. On the one hand there was the impossibility of achieving the desired results through normalisation and methodological schematics applied to the even-aged forest. On the other, *ad hoc* studies and surveys permitted the acquisition of greater knowledge of uneven-aged forests, highlighting the objective difficulty that applying the so-called *norm* would involve. Hence the shift towards ductile silvicultural systems and approximative planning methods.

7 – *The theory of the «normal forest»*

As soon as the French school freed itself from ideas originating on the opposite banks of the Rhine and defined its own management lines, clear contrast emerged between the two schools concerning silvicultural systems and methods. However, there was no divergence as to final goals. Both

maintained the need to «normalise» the structure of the forest to increase wood production. Regulations were based on the theory of the «normal forest». The trend was to create a forest – ideal for some, optimum for others – with a «regular» structure, characterised by the lack of «abnormalities» in density, in increment, in age classes for even-aged forests, and in diameter classes for uneven-aged forests. It was a forest in which not only the natural, but even the casual variables could be controlled ⁽²⁾.

The theory of the «normal forest» was widely accepted and accredited because, on the one hand it permitted the use of mathematical language, giving an appearance of objectivity to silviculture, yield regulation and forest economics. On the other hand, it gave foresters the security related to the possibility of applying experimentally obtained parameters. As we can see, the arguments in favour of accepting the principle of the «normal forest» in forest management are strong. But it is just as certain that the theory succumbs to the view of the forest as a *machine* that produces goods and services. And since this is the prevailing view, nearly all foresters, with the proper distinctions, declare themselves in agreement with this theory.

Much has been and is still being said about the concept of the «normal forest» and about the «norm».

PARDÉ (1930) maintained that:

The normal forest, the model forest, the ideal forest, represents the goal of forest regulation.

To explain the meaning and importance of the «*normal forest*» and of the «*norm*» COLETTE (1960) used a metaphor that renders the idea very well. He said that in the collective imagination of the foresters, the «normal forest» is like the

(2) The problem of the applicability of the theory of the «normal forest» has been analyzed by CIANCIO *et al.* (1994a; 1995a).

headlights of a car that show the way in the dark. In brief, the «normal forest» is the «*guiding idea*» towards the goal. In other words, it is the means to obtain stable and productive forests, arranged and structured in such a way as to perpetuate themselves and supply the maximum quantity of the desired goods (CIANCIO *et al.*, 1994b).

CANTIANI (1962) stated that:

The concept of the «normal forest» [...] is linked to constant production and [...], among other things, it changes in relation to variations in economic demands. We must admit that the forester, and mainly the forest yield regulator cannot set aside the notion of the normal forest, at least as an ideal model toward which the forester's actions must aim to obtain a growing stock structured and distributed in space so as to produce the maximum increment. It is true that the normal forest is flexible and variable, but we must agree that no rational economic theory can be separated from a norm because an arrangement with a temporary character in a forest enterprise brings with it very serious problems.

The validity and importance of the «normal forest» is also supported by SUSMEL (1986). He has made a significant contribution in relation to the normalisation of uneven-aged forests. His studies on the pure and mixed forests of the Eastern Alps and, partly, in the Apennine beech forests and evergreen oak stands (1955; 1956; 1959; 1970; 1980) allowed him, among other things, to identify and define the parameters that characterise the «norm». He identified:

[...] the characteristics of the uneven-aged forest in relation to the epigeous biospace, as modified by the plants and animals that populate a given physical environment. The most appropriate parameter for evaluating the volume of the system's epigeous biospace is the top height of the stand (the mean height of the dominant trees), a protected space within which all the physiological, biological and evolutionary processes of the community take place. Top height, directly measured in the forest, can readily be used to define the main features of the *normal forest, or rather of a forest in a state of cultivated equilibrium* [the italics are the authors'], and therefore readily prepare the structural model towards which restoration must be directed.

The point that SUSMEL makes – state of cultivated equilibrium rather than «normal forest» – is not insignificant. It is a distinction that cannot and should not be underestimated, to do so would be a grave error. In fact, it means that some certainties are brought into doubt: it is no longer the quest for an ideal entity, «the normal forest», that should guide the forester's actions, rather, and much more pragmatically, the goal should be that of creating an organised forest under the active and decisive guidance of man. A forest in the *state of cultivated equilibrium* as he maintains, without greatly modifying the soil-stand system, makes it possible to achieve specific goals. It is a significant passage: applied ecology starts to deeply impact on concepts that the dominant trend in forestry philosophy still considers inviolable on the basis that any other approach could lead to far-reaching technical-scientific upheavals. This kind of motivation is quite perplexing: it is not corroborated by any supporting arguments and is, therefore, unacceptable.

We must also say that regarding the application of this concept to forest management CIANCIO *et al.* (1994a; 1995b) have a totally different opinion. They argue that the theory of the «normal forest» is unacceptable, inappropriate and out of date if the forest is considered a «complex biological system», and treated in accordance with the criteria of *systemic silviculture* ⁽³⁾ and of *management on natural bases*. In this case, they maintain that *the forester must act on behalf*

(3) In this case giving an adjective to the noun silviculture is acceptable. In fact, in the common understanding of the term, silviculture is understood as a) forms of cultivation that concern the trees comprising the forest and undergrowth; and b) creation of the forest stands by seeding or planting with the specific aim of obtaining direct or indirect profit. «Systemic silviculture», on the other hand refers to a complex biological system, the forest, in which human intervention is motivated solely by the interest of the forest, and is in favor of its functionality.

of and in the interests of the forest, and not only to pursue direct and/or indirect gains. As in all human endeavours, whether we like it or not, it is the end that makes the difference. This proposition certainly leads towards another dimension of the forest and of forestry activities. If we prefer, it is a true scientific revolution in KUHN's definition of the term.

No one, however, has adequately considered the fact that the distinction between «normal forest» and «abnormal forest» always implies a «criterion of value». Replacing *normal* with *optimum*, or as the most farsighted scholars do, using the statistical terms *mean* or *average* instead of *normal* does not alter the logical position of the problem one iota. The issue cannot be resolved by the scientific method, that is, by observation and experimentation.

What are the consequences? The first and most important, because it is operational, is that forest management has been focused on the «normal forest», and this notwithstanding the theoretical and scientific inanities on which it is based. The second, less obvious but just as important, is that in effect, the theory of the «normal forest», only apparently facilitates the foresters' task while sheltering them from criticism. This also explains the success of a theory, which, on the one hand, implies the reductionism typical of the scientific method, that inevitably tends to simplify complex entities, and on the other hand, mattering little if it is outright or tacit, assumes a value judgement which offsets a hypothetical «normality» with a presumed real «abnormality».

8 – «*Naturalistic silviculture*» and «*silviculture on ecological bases*»

Following on the heels of some blatant failures resulting

from the application of the German school's «financial silviculture» theory, and under the impetus of society's demands, a new way of conceiving and viewing the forest came into being. Silviculture was increasingly oriented towards the application of low environmental-impact techniques. From intensive utilisation over vast areas, the first move was clear cutting on small areas, then shelterwood cutting and finally cutting individual trees. The study of natural phenomena became the focus for identifying cultivation guidelines.

ADOLPHE PARADE and KARL GAYER were the precursors of «naturalistic silviculture». PARADE's philosophy can be summarised by the famous aphorism «*Imiter la Nature, hâter son oeuvre*» – imitate Nature, hasten her work; and GAYER's (1901) in an equally famous maxim, «*Zurück der Natur*» – back to nature – which, on the one hand was an admonition not to build and cultivate pure and even aged forests, and on the other, an invitation to work in order to obtain natural regeneration. GAYER corroborated the concept by stating that «*In der Harmonie aller im Walde wirkenden Kraefte, liegt das Raetsel der Produktion*» – «naturalistic silviculture» is conceived in the spirit of «*a search for harmony among natural forces of production*».

At other times, we have argued that silviculture could not be defined as naturalistic (CIANCIO, 1981; 1990; 1991; CIANCIO and NOCENTINI, 1994a). This definition, even if it is already part of forestry parlance, is inappropriate since it presupposes a non-naturalistic silviculture. Therefore, it is more fitting to use the expression «silviculture on naturalistic bases», similar to what we do when we speak of «silviculture on ecological bases».

ALDO PAVARI made a significant contribution to the development of forestry philosophy in an ecological and naturalistic sense. In 1932 he affirmed that the current phase in the

evolution of silviculture could be defined as the «naturalistic phase». And in 1938 he reiterated the concept:

The increasingly closer bond between forestry disciplines and natural sciences that has developed in the past fifty years has led to this precise basic concept of modern silviculture: the forest, as a natural structure, is the result of a group of reciprocal relationships between the environment and plant life, and that modifications or substitutions of spontaneous forest stands have a profound impact on the equilibrium between the environment and the forest, in many cases jeopardising the stability and security of the forest itself, and of what should be the prime requisite of forest production: continuity in time and space.

However, to avoid misunderstandings, it is important to point out that in spite of improvements in cultivation methods related to the affirmation and development of this new concept, the goal of obtaining a maximum, constant and annual yield did not change at all. It continued to prevail over all other considerations. «Naturalistic silviculture» has been the object of many interpretations. Here are just a few of the most significant ones.

ALDO PAVARI (1929-30), in line with HEINRICH MAYR'S (1909) phytogeographic approach, said that «naturalistic silviculture» must be:

[...] supported at all times by scientific criteria taken from the great domain of the natural sciences»,

and based on

[...] an awareness of all the environmental factors that influence cultivation techniques».

He emphasised that in order to be truly useful to the forester, it must be guided by economic criteria. In other words, both the requirements of the species and the environment's features must be born in mind. Therefore, the introduction and cultivation of exotic forest species appropriately fit into this context.

His pupil, ALESSANDRO DE PHILIPPIS (1967) worked along the same lines:

The naturalistic approach in silviculture means subordinating the nature and scope of operations to a precise evaluation of their effects, so as to alter the bio-ecological equilibrium of the individual forest ecosystems as little as possible, or to restore it when it has been profoundly modified or destroyed.

But then he adds that:

[...] in practice naturalistic silviculture cannot always avoid modifying the floristic composition of the stand thus creating pure stands, and sometimes introducing species foreign to the site, nor can it reject other silvicultural forms or operations in regenerating and modelling the stands when the goal is to increase and stabilise productivity. What is important is that this takes place «*respecting the fundamental principles of forest ecology*», and within the limits of the validity of these principles in relation to the variations in environmental conditions and the subsequent adaptations in cultivation techniques. This concept was clearly illustrated by PAVARI in his «Lineamenti di silvicoltura comparata su basi ecologiche» that dates back to 1932, but can still be considered current and applicable.

PAVARI's other pupil, LUCIO SUSMEL was of another opinion, at least on the conceptual level. In 1980 he wrote that:

If the species is exotic (pines and firs, hybrid poplars, eucalyptus), man's intervention supporting the stand's equilibrium with energy inputs from the outside (nurseries, soil preparation, fertilisation, irrigation, disinfection, thinning, pruning, etc.) during the cycle will be maximum; at the end of the cycle, the stand, lacking homeostasis, will disappear and it will only be possible to regenerate it by artificial means.

Clearly such a cultivation system conflicts with the principles of «naturalistic silviculture». It seems appropriate to point out that the concept that cultivation of exotic forest species can be reconciled with «naturalistic silviculture», sustained on several occasions, starting with PAVARI in 1916 and then picked up by DE PHILIPPIS, is still current. The possibility of natural regeneration of an exotic species in a new environment has been pointed out and demonstrated by CIANCIO *et al.* (1981) with experimental data. The phenomenon is explained as a process of «*rinselvaticimento*» (going back

to a wild state), as distinguished from «spontaneization», that is normally correlated to natural regeneration of native species. OTTO, a forest ecologist from the University of Göttingen has recently joined these ranks (1990). He reaffirms that the use of exotic species can fit into the context of «naturalistic silviculture» – *silviculture proche de la nature*.

[...] the utilisation of exotic species is possible under very specific conditions. These species must be able to integrate themselves in the existing ecosystems. In order to be well integrated an exotic species must: be well suited to the site; not harm the site, or the humus, and take root easily; not propagate diseases; not be sensitive to diseases; be capable of natural regeneration; be capable of mixing with the native species; not hinder or impede the dynamic development (natural sequences) of the forest, but integrate with it.

Acceptance of this principle made it possible to introduce and cultivate exotic species, causing positive or negative changes to the landscape which, anyhow, has been upset to the point that it became unrecognisable.

Thus writes ITALO CALVINO (1957):

[...] on the plains and on the hillsides [...] vegetation has changed, no more evergreen oaks or elms: now Africa, Australia, the Americas, and the Indies are stretching their branches and roots out to here. The ancient plants have retreated to higher ground: olive trees on the hills, pines and chestnuts in the mountain forests; below, the coast of Australia, red with eucalyptus, overgrown with ficus, enormous, solitary garden plants, the rest is all palm trees with their dishevelled manes-dreary desert trees.

But, to tell the truth, the profound changes in the landscape caused by the destruction and degradation of the forests had already been pointed out in 1864, and then in the 1869 and 1872 editions of a book by the American scholar, GEORGE PERKINS MARSH.

In the preface to the original edition of «Men and Nature», he wrote that the purpose of his book was to describe the nature and approximately the extent of the changes induced by man's actions on the physical conditions

of our planet; to show the dangers that imprudence can produce and the need for precautions in all those works which in large proportions come between the spontaneous arrangements of the organic or inorganic world; to suggest the possibility and importance of *restoring disturbed harmonies*, and the material improvement of ruined and exhausted regions. He also illustrated the principle that man is, in genre and degree, a power of a higher order than any other form of life, which, like himself, eats from nature's abundant table. MARSH pointed out how, in the more primitive stages of life, man depends, for his food and clothing, on what animal and plant nature spontaneously provides, and therefore, his consumption of these products diminishes the quantity of the species that he uses. In more advanced civilisations he protects and propagates certain edible plants, birds and quadrupeds, and at the same time he makes war on rival organisms that prey on or inhibit the growth of the objects under his care. Thus, man's actions on the organic world tend to invert the original balance of his species, and while he diminishes the quantity of some, or even exterminates them entirely, he multiplies other forms of animal and plant life.

MARSH went on to say that man is always a disturbing agent. Wherever he puts his feet, the harmonies of nature fall into discord. The proportions and compensations that assured the stability of the existing arrangements are overturned. Native plants and animals are uprooted and replaced by others of foreign origin; spontaneous production is prevented or limited, and the face of the earth is stripped bare, or covered by a new and forced vegetation and foreign animal breeds. These changes, brought about deliberately, and these substitutions comprise great upheavals; but no matter how great their extent and importance, they are insignificant in comparison to the unforeseen and casual effects deriving from them.

From the scientific standpoint, MAYR's approach, expanded and perfected by PAVARI, belongs to the category that PAVARI himself defined as «silviculture on ecological bases» (1932; 1959). In fact, it implies the transfer of knowledge acquired in the fields of phytogeography, biology, ecology, phytosociology, etc., to forestry. PAVARI (1932) stated:

This universal character that silviculture is assuming renders imperative the need to understand forest ecology and derive those laws from it which can be combined in a system. Only in this way can we raise to the dignity of science what up to recently was not more than an art, a technique. With the modern orientation of silviculture on ecological bases [...] the various technical methods and forms of silviculture will be able to escape from the circle of an empiricism, albeit refined, only when they will be considered the consequences of given environmental conditions. Then, like forestry botanical geography, silviculture too, will find a systematic place in ecology.

And further:

[...] the study of comparative silviculture should lead to the identification of different homologous types or forms of silviculture that repeat themselves or at least resemble each other in areas with identical types of climate. It is hardly necessary to demonstrate what progress this organisation of silviculture on ecological bases would represent. It would provide the key to interpreting traditional systems, it would bring an end to long and sterile debates on the adoption of one system or the other, it would organise silviculture technique on naturalistic bases, avoiding those initial errors which, as I said earlier, have repercussions decades or even centuries later.

Even if «silviculture on ecological bases» which deserves the credit for having allowed silviculture into the world of science, led to radical modifications in the methods of forest cultivation, it did not cause any substantial changes regarding the objectives of this discipline: attainment of the maximum, in terms of both quality and quantity, wood production and hence financial income from the forest. PAVARI (1932) notes that silviculture without economic goals would be absurd.

JOSEPH POCKBERGER (1952) gave a different interpretation of

«naturalistic silviculture». He maintained the need for applying cultivation techniques that are capable of supporting the forest's evolution towards more natural forms, that is, uneven-aged. The reason, however, is that only this approach will assure the best economic results.

LUCIO SUSMEL (1980), an ardent and recognised supporter of «naturalistic silviculture» made an analysis which, is quite similar in some ways:

[...] naturalistic silviculture believes that greater probabilities of guaranteeing the stability of forests cultivated with less energetic, economic and ergonomic outlay, are obtained with structures and functionality similar to those of natural stands of the same types, the lives of which have continued unchanged for several thousand years. In temperate climates, it is a well known fact that natural forests are uneven-aged to varying degrees.

He further explained this concept by saying that:

The naturalistic line accurately imitates natural forests of various floristic types, trying to achieve, extensively and with the maximum possible capillarity cultivation models – ideal goals that can never be completely attained – which, like the natural models have the essential features of homeostasis.

He continued:

Naturalistic silviculture also aims at the production of organic matter useful to man, but – with a more holistic attitude – it also considers the fulfilment of the forest's other social functions (protection, health, recreation, culture, landscape).

HANS LEIBUNDGUT (1960) observed that:

Virgin forests can serve man only as a guiding light in the process of scientific evolution, providing knowledge of biological phenomena. But they cannot be a model to follow and imitate in silviculture because its (silviculture's) goals cannot be achieved other than through human intervention.

And therefore, he maintained (1982) that silviculture must know how to enhance natural resources, working at zero cost, to increment both the value and the quantity of wood production.

The *guiding concept* of «naturalistic silviculture» is therefore to eliminate empirical practices and benefit from knowledge acquired in other scientific fields in order to define low environmental-impact methods of cultivating forests. Notwithstanding all this, and all its various interpretations it is still and always firmly anchored to the theory of economic realism (CIANCIO, 1991).

In brief, «naturalistic silviculture» is distinguished by the fact that actions are undertaken with silvicultural criteria, but using different methods in relation to the ecological conditions, the type of forest and the management goals. With respect to the past, cultivation systems and productive arrangements have changed, but the financial aspects are still very much in the foreground. The cost/benefit analysis dominates the productive scenario. The pre-eminence of economics on forest regulation and silviculture is beyond discussion.

CIANCIO (1994a) and CIANCIO and NOCENTINI (1994a) maintain, however, that there is a profound difference between «naturalistic silviculture», «silviculture on ecological bases», and «silviculture on natural bases». They note that:

[...] silviculture on natural bases is an idea⁽⁴⁾, a protocol of intentions, which is then transformed into an open project. The idea is that of a forest as a subject with rights, the project is the consequent method of approach.

The difference is not insignificant: in this case the end is not that of pursuing profits, be they direct or indirect, as in «naturalistic silviculture» and «silviculture on ecological bases». Here it is the interests of the forest as a biological system that are pursued, working in such a manner as to favour the system's self-organisation.

(4) The concept of «naturalistic silviculture», not as a series of techniques to categorise in growing methods and systems, but as an idea has been embraced and supported, albeit with different motivations and intentions, by CRISTIANA COLPI in the essay *Which silviculture?* in *Il bosco e l'uomo* (1995).

9 – *The Swiss school: le Contrôle and the Femelschlag*

The Swiss forestry school was founded in 1855 as a section of the Zurich Polytechnic Institute. The factors that gave the decisive thrust for its creation were: «the decrease of pressure on the forest; the general awareness of problems concerning nature and protection of the forests; the actions of the pioneers to lay the foundations for the advent of silviculture» (SCHÜTZ 1989).

Over the years the Swiss school was characterised by sophisticated forest management, and an awareness of environmental issues. From the beginning it was decidedly oriented towards «naturalistic silviculture». It earned distinction in three fields that marked the evolution of forestry thought: HENRY BIOLLEY's *jardinage cultural* (1901); WALTER SCHAEIDLIN's «selective thinning» (1937); and HANS LEIBUNDGUT's *Femelschlag* (1946).

HENRY BIOLLEY rigorously applied *le jardinage cultural and le Contrôle*. He consistently maintained the validity of ADOLPHE GURNAUD's theory. He disseminated the principles on which the control method is based, and promoted a new trend of thought. In debates with supporters of the predictive, schematic and simplifying method of forest management, in 1920 he wrote that:

If there is a field closed to the positivism of modern science, it is that of forest management. It is not that attempts have not been made to subject management to strict rules, precise procedures. If it is there that positivism lays, it is abundant and excessive. But that is positivism per se, and it remains external to the object that it purports to consider [...].

The rejection of the notion of age and the definition of the «*useful effect*» were a different way of interpreting forest cultivation. The forest manager, who had to be both an artist and an economist, was allowed to work without any particular restrictions concerning cultivation. Forest treatment was

organised as experiments. The goal was that of harmonising natural forces to achieve – always and in any event – maximum wood production.

In BIOLLEY's own words:

«Produire»: ce mot renferme tout le devoir et devrait résumer tout le vouloir du sylviculteur» – «To produce»: this word encompasses all the duties and should summarise all the desires of the forester.

The idea of refined silviculture took on concrete form with WALTER SCHAEDELIN's «selective thinning» (1937). With this method, which was originally and not casually defined as «educational thinning», the silvicultural system, that is the sum of the actions that go into raising the stand to obtain the maximum value from wood yield, became a method for training the stand, concentrating production on the best subjects. Therefore it cannot and must not be a means of spacing trees in order to accelerate growth. The guiding principle behind this method is that selection during the cultivation process produces positive effects that are then translated into better quality and hence higher value of the product.

SCHAEDELIN's method was an important moment for silviculture: it showed the importance of artificial selection for the stability and biological equilibrium of the stand and at the same time it indicated the advantage of abandoning the idea of thinning to achieve maximum wood production. SCHAEDELIN's «selective thinning» was carried on, expanded and illustrated by his pupil and successor to the chair of silviculture at the Zurich Polytechnic Institute, HANS LEIBUNDGUT (1966). In addition to emphasising the importance of the method, LEIBUNDGUT maintained that due to the fact that its goal is to obtain maximum wood production, «silviculture on ecological bases», does not exclude the pursuit of other, environmental and social functions. In essence, he corroborates the theory of the forest's multiple functions and the related «trailing effect» that we will discuss later.

In 1946, with his presentation of *Femelschlag* HANS LEIBUNDGUT became a sponsor of extensive silviculture, freed from rotation and diameter criteria, and aimed at the creation of quality assortments. This form of cultivation is based on the desire to rationalise natural phenomena. The cultivation techniques derive from observation, and enhance the forest's natural mechanisms, which, precisely for this reason are economically advantageous. As we mentioned earlier, education, enhancing the forest's natural forces, and utilising individual production potential and other factors, fits into this context. All this requires input of energy, capital and qualified personnel. In the final analysis *Femelschlag* is a sophisticated form of cultivation based on aware and «soft» actions. Furthermore, it implies continuous research on new techniques that are advantageous from both the biological and economic standpoints. It is a refined form of management which nevertheless aims at enhancing production.

What conclusions can we draw from the Swiss school's orientation? There are mainly two. First, in order to identify the sequence of cultivation interventions to apply to the forest we must use the scientific method based on field observations and experiments. And up to this point, things proceed along well known paths. The second is more important: with his studies, arguments and experiments, LEIBUNDGUT unequivocally maintained that wood production is the only invariable in silviculture, especially in «naturalistic silviculture» the goals of which do not change to any substantial extent. In brief, *Femelschlag* changes the way trees are chosen for harvesting, but it does not change the fundamental concepts. Nor does it change the arrangements which in one way or another are oriented towards obtaining raw material, that is, wood, and in this case, of the best possible quality.

10 – *The uneven-aged forest: the shadow
of an historical and cultural prejudice*

The debate between the supporters of «financial silviculture» and of «naturalistic silviculture» went on for a long time. The fact is, that at the beginning of the twentieth century, selection cutting, strictly related to the mixed and uneven-aged forest, was not considered a true silvicultural system. Rather it was deemed commercial cutting that had nothing in common with specific silvicultural goals. The fact that this concept was widespread proves that the situation was actually so.

GIOVAN BATTISTA DA RIOS (1922) noted the almost total lack of interest in the subject in the schools:

Unfortunately scientific research aimed at providing some indication as to the ideal structure towards which our fir forests should aim in order to yield the maximum useful effect with the minimum utilisation of resources has not been, to my knowledge, as yet undertaken in Italy. The major contributions made to its resolution, even abroad, are not due to official science, and big experimental stations, because up to recently, these have considered the uneven-aged forest an irrational cultivation method.

PAVARI (1935) maintained that the selection system,

In the way that it has been carried out up to now and unfortunately continues to be widely applied in Italy's Apennine forests, is not a system because it consists solely of taking the best trees here and there, quantitatively and qualitatively impoverishing growing stock.

SUSMEL (1980) maintains that not only in the past, but also recently,

[...] «selection cuttings» are actually disastrous pillage.

SCHÜTZ (1989) observed that:

The notion of *jaminage* had a manifestly derogatory connotation in the beginning, it was synonymous with disorder and hence plundering of the forests, as there was still much evidence of illegal and unregulated use of the forests.

Only later did it become clear, mainly thanks to SUSMEL (1955; 1957; 1959; 1972; 1972; 1980) that selection cutting, in addition to being based on an elegant theory, could yield excellent results in maintaining biological equilibrium and at the same time, in satisfying production requirements. There is only one condition, however: correct application.

DRALET (1820) observed that:

If applied intelligently, selection cutting is a highly advantageous method of managing the forest.

PERONA (1895) believed that the uneven-aged forest,

[...] encompasses all the advantages of the shelterwood system without any of its problems.

GIUSEPPE DI TELLA (1926) affirmed that the selection system is typical of silver fir and mixed forests. He believed this system to be very interesting because, with a low growing stock, it is possible to obtain high unitary yield.

AMERIGO HOFMANN (1924) maintained that:

For small properties, selection cutting is the best system, even with respect to the conservation of site quality, and hence it is the conservative system *par excellence* for high mountain forests. However, the selection cut must be performed the proper way.

PAVARI (1953) affirmed that the selection system:

[...] could represent one of the highest levels of an eminently intensive silviculture.

And that the defects attributed to the system:

[...] are due to incorrect application. For example, lengthening the felling period [...] compromises the entire mechanism of proportions among young, middle and adult classes, thus upsetting the balance of the stand and often leading to the predominance of given classes, that is, to a gradual changeover from the uneven-aged to the even-aged forest. It is clear that stands modified in this way cannot be subject to selection cutting.

All this has had a great impact on the debate: much was said about the validity of the pure forest with respect to the

mixed and of the even-aged forest with respect to the uneven-aged.

PAVARI (1938) maintained that:

It would be a dangerous tendency to place too much emphasis on the even-aged forest, with respect to the uneven-aged forest deriving from selection cutting.

Further on, he continued that:

[...] selection cutting must be maintained to the broadest extent possible, gradually transforming the pure forest into a mixed one since the latter favours the success of the system itself. Instead of considering selection cutting as a system of the past, we must help it towards more intensive forms; it can only be applied, however, if there is an efficient road network and careful, scrupulous, technical management.

DE PHILIPPIS (1970) pointed out that the:

[...] *ideal forest model* towards which the forester should aim, while adapting to the variety of local conditions *is the model of the mixed, uneven-aged, naturally regenerated forest with structures and growing stock that are not too different from those of stands close to the natural state*. It is a forest with a permanent canopy, of maximum productive and protective efficiency, capable of regenerating and maintaining itself; it is a forest that meets the requirements of naturalistic silviculture and at the same time is capable of tolerating periodic utilisation as long as it is proportionate to the productive capacity (increment) of the stand.

However, he added that:

[...] In reality, the application of the model has been hindered by the development of radical socio-economic changes which have had direct consequences on production costs and market demands for different types of wood, or that have given rise to new demands in relation to the forest's roles.

And he continued that:

[...] It is probable that this model of the mixed, uneven-aged, free and selectively cut forest, by volume or small areas, so painstakingly developed, more often than not risks being relegated to the limbo of theory. [...] It is probable that the inevitable advent of mechanisation will cause a return to a preference for silvicultural systems based on artificial regeneration, since this implies fewer concerns for regulation and even more importantly, it allows for the creation of stands, which, due to lower initial

density and even arrangements of the trees in rows or in small groups, facilitates movement of the machinery and equipment.

In other words, a return to the past. The economic and social changes, market demands, labour costs, technological developments and the possibility of using machinery in the forest, cause and justify the return to simplified, schematic and therefore, orderly and regulated silviculture. It is the return of «financial silviculture». A century later, the principle of obtaining high income, in spite of the acquisition of new knowledge and the evolution of forestry thought, remains the basis for forest management.

Within the context of the uneven-aged forest, the debate was whether to promote a high growing stock and pursue a low increment rate, or a small growing stock which *ceteris paribus* and within certain limits, corresponds to a high increment rate.

PAVARI (1953) observed that:

The high yield of the selection forest as related to the relatively small growing stock, in economic terms, means a modest amount of capital that yields a high interest; a prerogative that makes this silvicultural system particularly suitable for private property.

And then:

The progress achieved in the application of selection cutting has restored honour to the system after a long period of unjustified neglect – it is both the silvicultural system most consistent with modern principles of «naturalistic silviculture» and the expression of intensive, high profit silviculture.

The discussion centred on various aspects. However, the central point, concerning the evolution of forestry thought was represented by the fact that some considered the uneven-aged structure as the closest to nature. The most convinced proponent of this theory is certainly SUSMEL. With arguments corroborated by facts, he maintained that the uneven-aged forest must come closer to the natural model. The problem,

however, is what we mean or should mean by uneven-aged forest. The issue is difficult to resolve because the underlying concept, almost like a conditioned reflex, is, in the minds of the foresters, related to a system based on unalterable criteria and rules, which must be applied. If they are not applied natural regeneration risks being discontinuous or lacking, with the stand evolving towards an even-aged structure.

PAVARI (1929-30) stated that:

[...] ...the typical uneven-aged, selection forest is the one where each unit of surface should have plants of all age classes, ranging from one year to the end of the cycle. That is because every year we should cut the mature tree, that is, the one that has reached the end of the rotation cycle. In practice, however, this does not occur, not only in cultivated forests, but also in virgin forests. Very often we see the distinction between two overlaying levels, one of adult plants and one of young plants; other times age (or at least size) classes are grouped together rather than intermixed.

SUSMEL (1980) maintained that:

Nothing prevents one to conceive, between the theoretical even-aged cutting series and the theoretical balanced uneven-aged stand, a sequence of intermediate forms like the ones, extremely variable, that are generally found in reality. The greater or lesser distance of the two theoretical extremes seems to be essentially correlated to the size of the groups that comprise the forest. However, there is a limit in the size of the groups under which the even-aged structure becomes uneven-aged and vice versa (SUSMEL, 1959). This limit is generally agreed to be around 1000 m² of surface area.

And he continued:

[...] taking for granted that the uneven-aged structure with individual-casual distribution of the trees («balanced»; «*einzelstammweise*» of the German authors) is the extreme case and as such it is rare, *the primary and secondary uneven-aged forests that man sees in front of him, never belong entirely to a «pure» type*. And the forester must constantly come to terms with this fact.

He also said that:

In the «perfect» form that often [...] is identified in the «balanced» structure, the uneven-aged forests are not very extensive.

PATRONE and SUSMEL agree that the balanced uneven-aged forest is more theoretical than practical, and this fully justifies the question that PATRONE (1975) raised, using one of CHRISTOFF WAGNER's metaphors: «The selection forest, is it real or is it a spectre?».

One thing is certain from all this: the uneven-aged forest presents a structure that varies from forest to forest in relation to the influence of physical and bioecological factors and of man's intervention. If we truly want to define it, we can say that it is characterised by a) almost continuous regeneration connected to the selection system; b) the lack of a defined rotation cycle replaced by the diameter criterion, and the fact that the selection cut is at the same time thinning and felling mature trees; c) complete canopy closure and a stratified structure which is often complex and multi-layered; d) considerable photosynthetic activity since all the strata are capable of photosynthesis and this involves all the vertical air space; e) nearly always a mixed composition; f) a growing stock which, in absolute terms, is lower with respect to even-aged forests, but uniformly distributed over the area and with few variations in time; g) the lack of correlation – or only correlation in the broad sense - between diameter and age, because in the uneven-aged forest, diameters are influenced more by social position than by age; and h) the lack of cutting area margins.

These points, all equally typical and important, draw the picture of the considerable complexity of the uneven-aged forest which, when there are no major upheavals, corresponds to marked stability, and one of the highest levels of biological efficiency among all the various forest formations.

In the most widely accepted meaning, at the scholastic level, the uneven aged forest comprises an aggregate of differently aged trees of various sizes (diameter and height), that are intimately mixed. It is tied to selection cutting. This

system calls for frequent interventions, repeated every (n) years, corresponding to the felling cycle, with which both the trees that have attained the cutting diameter and small, but older trees, or young trees that are living in precarious conditions and have little future, are removed. This type of intervention is defined as selection cutting.

Actually, this type of forest is rarely found on large areas, and when it is, it comprises the utmost in cultivation technique. PATRONE (1975; 1979) defined this type of forest as «*punctiform*» or balanced. A second way of conceiving the uneven-aged forest is that of an aggregate of even-aged «micro-stands» which cover less than 1000 m² of surface area (OFFICE NATIONAL DES FORÊTS, 1970; SUSMEL, 1980). It is the so-called *futaie jardiné par bouquets*, for the French, or *truppenweise* for the Germans, that PATRONE defines as the *atomistic* forest as compared with the *molecular* forest, consisting of small even-aged stands on areas exceeding 1000 m², that the French call *futaie par parquets* and the Germans, *horstweise* and *kleinflächig*.

According to VAN MIEGROET (1961) in SUSMEL (1964):

[...] the advantages that the supporters of naturalistic silviculture, aside from the hydrogeological and aesthetic benefits, attribute to this type of arrangement [*uneven-aged selection cutting* forest, authors' note] can be summarised as follows: higher economic yield; more lasting and constant high productivity; possibility of satisfying different and changing market needs; possibility of combining interventions on the wood mass with care for the stand and, usually, indirectly for the soil and possibility of modelling production to the highest qualitative level. Then there are other, no less important advantages, the greater resistance to the negative effects of the weather (mainly wind and snow) and lower risk of serious damage from parasites. The most significant fact that best summarises the basis of this assumption is the rarity of serious damages suffered by mixed, uneven-aged forests wherever these have not moved too far from the natural state. The main disadvantages are the delicacy of the silvicultural treatment which requires skilled, well-trained operators, and the impossibility, as imposed by the system's canons, of concentrating logging operations.

At a closer look the polemic was instrumental, it made no sense. The conflicts centred on more or less intensive management, more or less concentrated in time and space. The greater functional efficiency and stability of the uneven-aged forest was confused with the equation: uneven-aged structure equals natural structure. Hence the label, «naturalistic silviculture». The implications of this conceptual error have not been adequately understood or explained. Many scholars, including fine naturalists, ecologists and foresters are still convinced that the uneven-aged forest is the structure closest to the natural form. And this thesis is being propounded by the media and among laymen.

The uneven-aged forest, as an expression of «naturalistic silviculture» is, to say the least, a peculiar thesis. But it has acquired fame and approval over the years. And since the issue involves not only the operational aspects of silviculture, forest regulation and economics, but also the forest's position in systemic thought and ecological culture, it may be worthwhile to try to shed some light on the matter.

This necessity is also confirmed, albeit indirectly, by SCHÜTZ (1989). He writes that in the early decades of the twentieth century, even if in different modes and forms, *Femelschlag* started to be applied in German-speaking Alpine countries.

The idea of *jardinage* [that is, selection cutting, typical of the uneven-aged forest (the italics and the note are the authors'')] developed practically at the same time, fitting into the same current of thought, even if today, some incorrectly try to oppose it to the shelterwood system. Both systems pursue the same goal, that of creating mixed and differentiated stands.

It has been called a peculiar thesis, and the reason is simple. The uneven-aged forest, as it is understood, studied, codified and applied in forest science and technique is the direct consequence of an indefinite series of cultivation interventions. The intent is dual. The first concerns cultivation tech-

nique which is recurring and capillary to achieve stand continuity at zero cost, that is, through natural regeneration. The second refers to the financial aspects: obtaining high income by harvesting assortments of predetermined size.

Since all this has been known from a long time we could ask whether there is a basis for considering the above equation – uneven aged structure equal to natural structure – as valid. The answer is complex because natural structure is extremely variable and precisely for that reason, cannot be compared to a model. Therefore, it cannot be defined in time and space, and especially not on a small scale. This means that the structure of the uneven-aged forest obtained by silvicultural interventions is always a simplification of the natural state. The uneven-aged forest is achieved when *normalisation* is pushed to the maximum level so that disorder is more apparent than real: the forest is forced into the so-called *norm*: a technical structure grafted onto a cultivation method connected to a specific structural type.

The uneven-aged forest involves cultivation and utilisation operations that are frequent and scattered in space. This way, over the years, a «constructed» forest is created which represents the utmost in cultivation and in the forester's professional commitment. Hence, it is an artificial forest. Or rather, as ALFRED DENGLER (1930) said, «extremely artificial». Given this situation, we could put forth the hypothesis that there is an intrinsic contradiction between uneven-aged forests and «naturalistic silviculture». But it is not so. Naturalistic silviculture pursues the same end, to obtain maximum wood production, and all actions are rooted in this conceptual context.

11 – *The Dauerwald theory of the «permanent forest»*

Categories and labels are useful, but merely as scholastic

schemes. The most convincing example of this assumption is the theory of the «*permanent forest*», ALFRED MÖLLER's *Dauerwald* (1922). In its day, this theory was the object of much discussion. However, it does deserve credit for having profoundly influenced forestry thought in this century.

The *Dauerwald* introduces the principle according to which, in the cultivation approach, it is the forest that «tells» the forester what should be the extent of his intervention, and not the other way around. Man's necessities should not prevail over the needs of the forest. And therefore, they cannot and should not determine cultivation methods and forms. MÖLLER's philosophy can be summarised in the phrase: «I believe I have found the right word. The forest is truly a living organism». Precisely, it is an organism and must be treated and managed as such.

MÖLLER then explained how he envisioned the forest:

The forest does not consist merely of trees. Everything in the space between the tips of the branches and the ends of the roots, that moves, lives and is there, is the forest. The world of the birds, game, all the other fauna, the flora, the mushrooms; they are all part of the forest. Even the ground itself must be included, since it is not an inert stage, but a living thing. The land in the forest is not dead, but living, it is an essential organ in this complex organism.

Thus, the «*permanent forest*» is a revolutionary and at the same time, farsighted theory. That is why it was either passionately defended, or liquidated, as it in fact, most hastily, was. The organicistic view, which enjoyed so much success in America with F.E. CLEMENTS, was not as lucky as it should have been among European foresters.

DENGLER (1930) observed that:

It is exaggerated to conceive the forest as an organism, as the recent movement towards the *Dauerwald* does. The members of the forest are not organs in the true sense of the word (organs=instruments), since they do not have purpose unto themselves, their own function or role and do not obtain their ability to live and function from being part of the associa-

tion. The forest, then, does not develop like an organism from the inside growing outwards, rather its components come together from the outside, from a primitive free state, as anyone can see by observing the formation of a new forest. The bond between one species and another is much less close than that between the various organs of a real organism. Even if we wanted to use the term organism in a more or less approximate manner, its use could lead to extreme consequences, as always occurs in cases of similar exaggerations.

Then, PAVARI (1932) noted that:

It is precisely the Germans who acknowledge the error [*he refers to economic-financial silviculture that had led to the spread of pure and even-aged spruce and Scots pine stands in Germany, replacing the mixed, primarily beech and oak forests* – authors' note], in fact some of them recognise it so outspokenly that they go to the other extreme, that is concepts of silviculture methods, such as the «Dauerwald» in which the economic goal is practically lost.

SCHÜTZ (1989) emphasised that:

It [*naturalistic silviculture*»] is distinguished from the narrower, even dogmatic track [*here is the prejudice: the strongest and from many stand-points the most unjustified indictment* – authors' note] of «*naturgemässer Waldbau*» that developed in the spirit of the permanent forest after A. Möller (1922).

Perhaps MÖLLER was ahead of his time. And many foresters have not understood that, with appropriate adjustments, the *Dauerwald* could have made a decisive contribution to the progress and development of forest science and technique.

VALERIO GIACOMINI (1964) stated that:

[...] an organicistic view [...] is always more useful and closer to the admirably complex and orderly reality of the living world around us, of those denials that lead to rejection, to agnosticism, even in honour of scientific rigor founded on the most objective causal study.

The «permanent forest» is neither a silvicultural system, nor a norm to be applied. It is a protocol of cultivation intentions, aimed at conserving the efficiency of the forest, and

fulfilling its needs. In this way MÖLLER pitted himself against the supporters of the doctrine based on the principle of imposing an artificial and contrived order on the forest. It is unusual and at the same time significant that GENEROSO PATRONE, convinced supporter of this doctrine, praised the *Dauerwald* philosophy, identifying it as a *general spirit* with which problems can be faced and resolved case by case. Perhaps a similar motivation – that undoubtedly leads to a different way of seeing and interpreting the forest – can prefigure the *possible horizon* of the forestry issue (CIANCIO, 1991b).

An analysis of MÖLLER's thought leads to a dual conclusion. The first (CIANCIO, 1991b) is that:

The guiding idea capable of bringing about the necessary changes in forest management takes shape in considering the forest as the *subject* rather than the *object* of silviculture, forest regulation and forest economics. In this way [...] we give an indirect yet exhaustive reply to the two basic objections against foresters raised by many naturalists and environmentalists: the anthropocentric view and the desire to dominate nature.

The second is that with the affirmation of ecological thought, the principles of the «permanent forest» will probably be reconsidered to develop a new line of research and trigger a process of radical changes in our way of seeing the forest.

The *Dauerwald* overturns all the dictates of forestry doctrine: in this case inverting the order of the factors changes the result, and significantly at that (CIANCIO, 1991b).

This is what happened with Gurnaud's method of control.

12 – *The theory of the multifunctional forest: possibilities and limits*

The theory of multifunctionality of the forest (DIETRICH, 1941, in SCHÜTZ, 1989, 1991) with which the concept known as

«wake effect» (*Kielwassertheorie*) is correlated (DEL FAVERO, 1990; SCHÜTZ, 1989; 1991) was born and developed as a reaction to «forest statics». It derives from the principles of «naturalistic silviculture». A major turning point was reached in the forties, with the presentation and rapid affirmation of this theory. Even today, many scholars and technicians refer to the multifunctionality of the forest, almost always explicitly, sometimes implicitly.

According to this theory and the consequent «wake effect» – whether cultivation be intensive or extensive, economic or naturalistic, regulated or free, quantitative or qualitative, etc., the basic principles of forest management do not change. Wood production is still the predominant function. It automatically carries along the others and it does not involve any significant financial problems.

The multifunctionality of the forest and the leading concept of the productive function were perhaps most effectively theorised by PATRONE (1972). He said that:

[...] when the forest is orderly and managed in such a manner as to guarantee the maximum, in economic terms, of wood production, it guarantees the maximum output of goods and services for the nation. All of this takes place in harmony with a golden principle of universal order according to which, in the case of the producing of joint goods, management aimed at protecting one of them is such that it safeguards the others as well.

The most alert economists and foresters consider the «wake effect», at least in the strict sense of the term as inappropriate and untimely. However, forest management, with aware, even if not always declared actions, continued and continues to favour the productive function. The other functions – protection, accumulation of CO₂, recreation, aesthetics, education, conservation of biodiversity, reserves, etc. – in general and except for a few special cases, are considered secondary: a corollary to the priority function which is still and always, wood production. On the other hand, objectively

speaking, it could not be otherwise. The forest is nearly always classified according to its most obvious, macroscopic features: trees.

The arguments against the multifunctionality theory are many. Here we will list only those that can be readily perceived. In the first place, management aimed at achieving several predefined functions, involves extensive silviculture, based on specific and precise actions or measures. According to some it is zero cost silviculture. According to others it is financially onerous. However, it always involves major inputs of energy, labour and capital. Therefore, it conflicts with the postulate according to which both high income and «indirect utility» are goals to be pursued contemporaneously. What is more, the latter, that is the benefits deriving from some of the functions listed above, are not yet completely quantifiable notwithstanding all the efforts that have been made and the studies and research still in progress.

In the second place, since the multifunctionality theory remains tied to a prevailing function, management connected with this theory strongly limits and in some cases, eliminates crop flexibility, whereas even according to traditional canons, it should adapt to changing environmental, economic and social conditions. This type of management aims at a priority goal, no matter what it may be. Therefore, the forest is first labelled and then managed in relation to its primary function. The models currently applied to forest planning confirm this fact. Multi-criteria analyses, for example, serve to identify the primary function to be assigned to a specific forest or part of a forest. And then, management is adapted accordingly.

DE PHILIPPIS (1972) affirmed that:

It would be wise to clarify that «multiple use» does not mean that each forest must serve all purposes since it is capable of carrying out all its functions in an equally effective manner, nor does it mean that all forests

must serve all purposes at the same time. Multiple use also, and perhaps mainly, means *diversified use*. It is obvious that only the reality of the several situations can help establish what is the most favourable use or combination of compatible uses that can be implemented within the context of a given natural and human environment, on a case by case basis.

SUSMEL (1980) emphasised that:

The economic goals (*wood and other products*) and the social functions (*landscape, tourism-recreation, hunting, etc.*) [the italics in parentheses are the authors' from SUSMEL (1986b)] of the forest may or may not be compatible with each other, according to the stand's level of «specialisation». The more stands are created or modelled to fulfil one or a few established purposes, the more difficult it is to achieve harmony among the various functions. Indirect benefits interfere with direct utility, and by attempting an integral reconciliation, the conflict ends by imposing compromises which, without being able to avoid limitations on use, have repercussions on management causing loss of income and higher costs. Although each model can perform several functions (such as protective and hygienic or sanitary as a minimum) simultaneously, not one is capable of yielding the maximum in all of them together. In the planning stages, therefore, it is worthwhile to distinguish the models destined to fulfil the need for certain indirect services such as soil protection or conservation, landscape restoration or construction, or other indirect services, such as recreation and hunting, from the models earmarked primarily or exclusively for wood production.

MCQUILLAN (1990) shares the same opinion, maintaining that management based on compromise between conflicting needs can only lead to

[...] some optimal level of multiple-use mediocrity.

In this way, and it matters little whether consciously or not, we return to monofunctionality. Or rather multifunctionality and its related «wake effect». However, we must note that the small sizes of our forests do not permit classification on the basis of a prevailing function. Such a clear distinction is possible even if it is not acceptable from the ecosystem standpoint in countries such as the United States of America, Canada, Brazil, Russia, etc., where forest areas are distributed on a much vaster scale.

This theory, therefore, is not only reductive, it is much more. It is laden with risks. The most serious of which is the danger of the system's collapse. In the bioeconomical sense it is also essentially unproductive. On the one hand it causes an impoverishment of the system – structural simplification, reduction of biodiversity, energy deficits, etc. On the other hand, it has a negative impact on bioecological functionality, weakening the interaction among the system's components. In other words: it threatens existing balances and reduces the overall biological productivity of the forest.

And finally, since management is implemented on the basis of a priority function, what went out the door indirectly comes back in through the window – and that is the financial concept. The fact that the forest provides several services contemporaneously is taken into account, but, only if in a softer manner, its bioecological capacity is forced beyond the system's limits. In other words, the end makes no difference, as, instead, it should.

13 – *The Italian school - foundation and development*

This brief historical excursus would not be complete if we did not mention the Italian school which, as we have seen, and will see even better below, has made a significant, though internationally little-known, contribution to the progress of forest science. It was established in 1869, with headquarters at Vallombrosa, as the «R. Istituto forestale di Vallombrosa» (Royal forestry Institute of Vallombrosa).

With regard to the school's aims, in the opening address presented on 15 August of that year, LUIGI LUZZATTI (in MUZZI, 1970) stated that:

It [*the Vallombrosa forestry school*] cannot be considered a bureaucratic tool to create forestry technicians, to give examinations and to

advance careers. It must be the head and the heart of Italian forest restoration. Simple and strong laws would not be worth anything without the light of professional skill. With that flame, translated into a new awareness of the public good, which can daringly be defined as «forestry awareness» [...].

The expression «forestry awareness», that had been the object of FRANCESCO SAVERIO NITTI's facile sarcasm had value for LUZZATTI, and as such was a goal to be reached. While he was minister of agriculture, industry and commerce on 11 February 1910 he presented a bill to the Chamber of Deputies for the reform of the forest administration, to expand the public forest domain and to protect and stimulate silviculture. He returned to the issue to reaffirm the need for «reawakening and creating a forestry awareness in our country». Regarding forestry education he wrote that:

[...] the new law has provisions for future measures needed mainly to make the *Scuola di Vallombrosa* a true institute of higher learning in forestry. Through the order and severity of the studies, and the professional skills of its faculty, the *Scuola di Vallombrosa* is not second to any of the foreign schools: however, we must raise the level of teaching and its equipment and endowment [...] (MUZZI 1970).

The expression «forestry awareness» is emblematic: today it could be replaced by «forestry ethics», or proper behaviour and a respectful attitude towards the forest.

To this end LUZZATTI believed that it was necessary for the teaching to be rigorous and of a high level. Thus, at the end of the debate on the bill, he exclaimed that:

Having created forestry awareness it is appropriate to create forestry education, that is, after the desire, comes the knowledge.

Decades later, the lesson we can learn from LUZZATTI's far-sighted view is that the «forestry awareness» and «forestry knowledge» are necessary conditions, but alone not sufficient for tackling the forest issue appropriately. In addition to creating «forestry ethics» and «forestry knowledge», it is

essential to create a «forestry culture». We must promote a common feeling: the awareness of the need and importance of respect and love for the forest as a «value unto itself».

In 1914 the Vallombrosa school was transformed into the «Istituto Superiore Forestale Nazionale» with headquarters in Florence, and ARRIGO SERPIERI was invited to direct it. It is significant to note that in 1921, the «Stazione Sperimentale di Selvicoltura» was established and annexed to the «Istituto Superiore Forestale Nazionale», with the role of:

[...] improving knowledge and increasing Italian wood production, through experimental plantations even with exotic forest species that produce fine timber. The «Stazione Sperimentale» – since 1967 it is the «Istituto Sperimentale per la Selvicoltura» in Arezzo – was also assigned the conduct of research and experiments in the forest, on the basis of the institute's laboratory programs (MUZZI, 1970).

ALDO PAVARI, appointed director, made a decisive contribution to the development of Italian dendrology and silviculture. Among other things, he enlarged and expanded the Arboretum at Vallombrosa that had been established by PERONA. Here, since it is strictly related to the station's assigned duties, (although it encompasses much more) we must mention the impressive work by PAVARI and DE PHILIPPIS, published in 1941 entitled *La sperimentazione di specie forestali esotiche in Italia. Risultati del primo ventennio (Experiments on exotic forest species in Italy. Results of the first twenty years)*, a book which, according to MAGINI (1973), WRIGHT considered a model for the study of exotic species.

In 1924 the «Istituto Superiore Forestale Nazionale» was transformed into the «Istituto Superiore Agrario e Forestale». But this was not the end of the road: in 1931 two courses were established within the institute, one for a university degree in agricultural science, and the other for a degree in forest science. In 1936 the Istituto became the Faculty of Agricultural Science of the University of Florence, with sep-

arate courses in agriculture and forestry. Later, other degree programs in forest science were established: first at the University of Padua, then at Bari, Turin, Viterbo, Potenza, Reggio Calabria, Bivona (Palermo) and Nuoro. This proliferation of degree programs in forest science was strongly criticised by many, sometimes with valid arguments, but more often with instrumental criticism.

PATRONE (1970) wrote that:

The School of Florence, heir and guardian of the noble traditions of the Vallombrosa school is now flanked [...] by two others, in Padua and Bari. By creating these schools the foundations have been laid for dialogue and exchange of ideas which, up to yesterday were lacking and which comprise the basis for all technical and scientific progress. With three centres for study we can emerge from the static phase and decidedly enter the dynamic phase. In silviculture, more than in other subjects, exchange of ideas, comparisons of concepts and theses is the source of progress, also because, generally the data on which theories are constructed and which serve to explain and relate the facts are not easily ascertainable and require observations that cannot be completed in just a few years.

How can we not agree? The effort in the past few decades has been considerable and bears witness to the advances of the «forestry awareness» of which LUZZATTI spoke at the end of the nineteenth century. Our country, which sits in the middle of the Mediterranean, has complex and varied forestry problems and issues. And this is precisely the reason that all-purpose cultivation recipes are not acceptable. In forestry, furthermore, recipes are hardly ever useful, except perhaps for school-level simplifications. And this holds even more true in a country such as this, that is so diversified in the physical, ecological, vegetational and socio-economic sense. It is sufficient to remember that on the one hand the effects of cultivation approaches are measured over the long-term and that on the other hand, we work in a changing environment. Under these conditions the variability of responses in time and space is the rule, homogeneity the exception. Thus,

the need for letting concepts and experiences mature in relation to the different realities arises.

An important and highly significant moment in the development of the Italian school was the establishment of the «Accademia Italiana di Scienze Forestali» on 21 June 1951, through the desire and will of the faculty of forestry sciences of the University of Florence, and a group of high-level officials from the Forestry Administration.

The new Academy's program is to contribute to the progress of forest science, economics and law as they apply to silviculture as factors in the national prosperity. The Academy pursues these ends: promoting studies, research and experiments on technical, economic and law issues concerning silviculture; organising conferences to discuss the major technical, economic and legal issues involving silviculture in the context of the national economy; organising lessons and lectures by scholars or other persons invited by the Board; establishing centres, observatories, laboratories and study committees; publishing academic proceedings, studies, surveys, monographs, collections of technical-scientific works and journals, etc. (MUZZI, 1970).

Nor should we forget the creation of important research institutes that made an essential contribution to the development of cultivation methods and techniques in specific sectors, not the last of which are genetics and tree breeding, and arboriculture for wood production, that cannot be analysed here because the issue deviates from the main topic of this essay. In addition to those of the university and of the Ministry of Agricultural and Forestry Resources, significant scientific and technical results have been achieved by the «Istituto di Sperimentazione per la Pioppicoltura» of Casale Monferrato (Alessandria); the «Centro di Sperimentazione Agricola e Forestale» of Rome; the «Istituto Nazionale per le Piante da Legno» of Turin; and for the C.N.R. (National Research Council), the «Centro di studio per la Patologia delle Specie Legnose Montane» of Florence; the «Istituto per l'Agroselvicoltura» of Porano (Terni); the «Istituto di Ecolo-

gia e Idrologia Forestale» (Cosenza); the «Istituto Miglioramento genetico delle Piante Forestali»; and the «Istituto per la Ricerca sul Legno» of Florence.

13.1 – Guidelines, trends and technical-scientific results

The Vallombrosa school had a distinguished faculty. ADOLFO DI BÉRENGER was the first director, and, as in the case of LORENTZ and GURNAUD, in 1878, by order of SALVATORE MAJORANA-CALATABIANO, then minister of agriculture, he was forced into early retirement for having openly criticised the forestry law of 1877; then came FRANCESCO PICCIOLI, VITTORIO PERONA and ALBERTO COTTA. To realise the contribution that the Vallombrosa school made, it is sufficient to mention just a few of the most well-known works: *Archeologia forestale* by DI BÉRENGER and *Economia forestale* by PERONA.

From its beginnings, the Italian school felt the influence of both the German economic-financial school and the French naturalistic school. Initially, it followed the guidelines of the German school. For this it was accused of cultural submissiveness and mainly of not having taken Italian forestry issues into due consideration.

In the preface to his *Economia forestale - dendrometria* (Forest economics and mensuration), PERONA (1914) defended himself by saying that:

The nearly total lack of Italian works in this branch of forest science, and mainly of experimental data forced me to make substantial use of foreign publications and experiments, mainly German. For this reason, perhaps, there will be no lack of critics who accuse me of being a Germanophile; to them I will reply using Luzzatti's wise words, that science has no nationality.

PATRONE (1970) gave an entirely plausible explanation, by saying that:

Faced with the lack of a method and systematic handling of Italian

problems [...], the Vallombrosa school was forced to focus its teachings on disciplines dominated by general laws, not related to the environment. Thus it gave wide berth more than to silviculture proper, to some chapters of forest economics, such as forest statics, yield regulation, forest valuation, watershed management, that is to a group of disciplines which, together with silviculture, form the backbone of forestry activities. [...] The Vallombrosa school did not fall back on the German school because it was more harmonious, elegant, or persuasive than the French, but because the topics that exerted a greater attraction for the most authoritative minds, those who comprised the driving force, concerned economics, albeit limited to a few chapters, forest valuation, forest mensuration, watershed management, wood technology and so forth. However, we must acknowledge that, as regards teaching of silviculture proper, the Vallombrosa school was much closer to the French school in terms of doctrine. [...]

An objective review can confirm that Vallombrosa distinguished itself from both the German and French schools because it was quickly understood that there was indeed a need to make an attempt to find a point of equilibrium between the two driving concepts. There were no generalisations as to form of management or silvicultural system: these were the results of case by case, situation by situation studies. Treatment on small areas was theorised. The choice of cultivation techniques was the result of an analysis of the physical, economic and cultural environment. The area regulation method of yield regulation was preferred because of its simplicity and safety of application. It was believed to be better in tune with the reality of our forests. The experimental concept prevailed and a definite boundary was drawn: not to make any substantial changes until the cultivation and economic advantages had been ascertained.

Two opposing currents of thought developed within this conceptual context, but they met at the focal point of the perpetuity and profitability of the forest. This was the main point for both, the impassable limit for silviculture. The bio-ecological current was led by ALDO PAVARI, the economic one by GENEROSO PATRONE.

PAVARI (1932; 1938) took a definite stand by stating that:

[...] the forest, as a natural formation is the result of a series of complex reciprocal relationships between environment and vegetation, [...] and modifications or changes in natural forest stands have profound repercussions on the equilibrium between environment and forest, such as to endanger the stability and safety of the forest itself in many cases, thus endangering what are considered the main requisites of forest production: continuity in time and space. This naturalistic and ecological concept of silviculture often conflicts with the financial concept which is based on sweeping changes or even the complete replacement of natural forest associations with artificial stands in order to achieve a higher yield both in timber quality and quantity.

He maintained that the forests must be used cautiously, rationally and at the same time intensively. He considered the rigorous application of silvicultural systems and techniques indispensable for obtaining the maximum bio-ecological functionality of the forest. He insisted on thinning and urged towards improving forest yield and expanding forested areas. This presupposed cultivation methods aimed at achieving higher yield and use of the forest correlated to human needs.

PATRONE, following in DI TELLA's footsteps on the one hand, and ARRIGO SERPIERI's on the other, took a stand and theorised the orderly arrangement, favouring the economic line as the basis for a general order of universal value.

He tried (1980) to combine the two concepts in the economic moment: a productive forest,

[...] by satisfying the unsurpassable principle of the continuity of production and hence of the forest,

assures all the other functions. He identified these two concepts with two adjectives (1981), «classic silviculture» and «romantic silviculture».

Regular silviculture, based on the even-aged forest and which can be defined as classic is countered by an *irregular* silviculture that denies the validity of any system that can be tied to a theory, and delights in implementing actions in a case by case, episodic and unsystematic manner, that

gratifies intuition. There is no longer the tranquillity of universal laws, but continuous originality in the torment of an ever-new and never completed experiment. This silviculture can readily be described as romantic. The origin of the classification derives, in the final analysis, from two different concepts of forestry: the forest as a natural entity – the biological issue; the forest as a means of production – the economic issue. It is much like saying, in architecture, the aesthetic, eurythmic issue, or the functional issue. Classic silviculture tends towards the combination of biological and economic facts in a single whole, to resolve the problem viewed in its overall complexity, and universality, once and for all. In concrete terms, classic silviculture brings together and harmonises the two issues, it reduces the biological strife to a periodic eurythmia of phenomena of quantity, and the economic issue to a periodic recourse of increases in value.

And yet, even though PATRONE explicitly declared his preference for classic silviculture – in fact all of his far-reaching, important work centres on this concept – he felt that there was something not entirely convincing in this desire to classify the forest and silviculture according to rigid, scholastic schemes.

In 1981 he wrote that:

For the elect, silviculture, beyond any academic definition, is symphony, poetry, because it is creation, *art*. Silviculture is art because the equilibrium and trends that develop in the forest cannot be easily qualified or quantified, they can only be felt. It is art because silviculture is not *unitary*, there are no two identical forests, in fact, there are no two identical sections in one forest [...]

And further on:

Only if the forester has *intuition*, sensitivity to the forest, can he overcome the obstacles, bend the constraints, mould science and technique, and hence, create and build a luxuriant forest that produces a high yield of goods and services. On the other hand, when intuition is entirely or partly lacking, the resulting forests are flat and poorly, if at all productive, destined to disappear sooner or later.

SUSMEL (1964; 1986) as we have mentioned has a clearly naturalistic view of the forest and silviculture. He pinpointed

the need to cultivate forests that are self-sufficient and in balance with the environment. All his studies and research are based on this, and he denounces the faults of excess artificiality.

[...] in the seventeenth century the monks at Vallombrosa were the precursors, on the Tuscan Apennines, of a silviculture that, two centuries later, would be widely applied in Europe. In place of selection cutting, the monks elevated clear cutting to a system, replacing natural regeneration with artificial, broad-leaved trees with conifers. The soil was tilled and farm crops were cultivated between one forest cycle and the other. This led to the domination of the monospecific, even-aged conifer stands. In essentially identical form, artificial silviculture reached its culmination more than two centuries later when it began to spread throughout Central Europe. The financial balance of this system, initially positive, was not slow to reveal its major liabilities. The biological involution caused by the pure and even-aged state of the forest, soon filled the experiment with cracks. In Germany it caused real catastrophes in more than one case (SUSMEL, 1964b). All this (SUSMEL, 1986b) led to the decline of the theory and the practice of even-aged, clear-cut forests. The voice of German silviculture was missing from the chorus of repudiations that was reaching a crescendo over the years. It recently made itself heard as an epilogue with the weight of a dramatically negative experience. There were two main factors that contributed to the development of this indictment, on the one hand largely proven facts [...], and on the other, the growth during the post-war period of the ecosystemic concept of the forest, which is now shared everywhere and by all. Naturalistic silviculture has its fundamental credo in the need for supporting Nature's work, and in the awareness of the danger of going too strongly against the laws which govern the life of the forest (SUSMEL, 1964b).

ALESSANDRO DE PHILIPPIS (1967) took a position that can be described as intermediate. On the one hand he agreed with the concept of silviculture that takes the forest-environment relationship into account – «silviculture on ecological bases». On the other hand he pragmatically identified in the even-aged forest – as long as the species and growing techniques were selected and applied in harmony with the specie's needs and the station's conditions – the contact

points needed to pursue continuity and achieve functional efficiency. In brief, he maintained that:

[...] the two ways are not mutually exclusive, nor are they necessarily in conflict with each other.

According to DE PHILIPPIS, natural regeneration and the irreversibility of forest cultivation are the principles on which silviculture must be based. Thus (1972):

[...] the need for decisive action to protect and extend the forests, the essential factor in biological and environmental equilibrium, is increasingly obviously. This action does not preclude the productive utilisation of the forests, which, in most cases is a necessity. However, it is the specific and irreplaceable role of silviculture to care for the forests, and never to compromise the regeneration of the stand and its equilibrium with the physical and biotic environment.

With reference to the two concepts mentioned earlier, VALERIO GIACOMINI (1964) faced the issue, and, picking up a concept expressed by ALBERTO COTTA (1952), confirmed the need for harmonising the laws of man (economic laws) with those of nature in a manner that does not dangerously alter the original balances.

What conclusions can we draw from this array of positions? One fact emerges clearly and unequivocally: techniques change and cultivation becomes more or less intensive, more or less artificial; methods of harvesting wood change and arrangements become more or less regular. However, *mutatis mutandis*, albeit with the appropriate distinctions and nuances, one point remains fixed and unchangeable for all: pursuit of high quantity, and high quality wood production, and hence, pursuit of high income.

13.2 – The scientific bases of silviculture

The Italian school's contribution to this field was and

remains essential. ALDO PAVARI was the most effective theoretician of «silviculture on ecological bases». His interpretations broadened the horizons. Forest genetics, ecology and phytogeography became the basis for silviculture.

The main innovation was to consider silviculture an experimental science. On one side cultivation techniques had to be the results of incontrovertible data, defined by experiments and the help of the fundamental disciplines. On the other, it was established that:

[...] under similar climatic conditions, going beyond regional boundaries and floristic composition, we find comparable forests to which similar cultivation methods can be applied. (PAVARI, 1941).

This new outlook made it possible to deal with issues that had been considered unresolvable. The knowledge of the geographical distribution of various species and their needs, of climatic analogies and the study of local provenances comprises the basis of silviculture. This framework also encompassed the cultivation of exotic species as long as they gave guarantees of adaptation, assured higher yield and formed stable stands (CIANCIO, 1981; CIANCIO *et al.*, 1981; OTTO, 1990).

It was just a short step from silviculture proper to arboriculture for wood production. But if cultivating forest trees with the aim of producing significant quantities of wood or wood with special qualities soon became an accepted practice, the same did not hold true on the theoretical level. In fact, there was practically a rejection: the conceptual separation of the two disciplines was at first only acceptable for cultivating poplars, and perhaps eucalyptus. Only recently have the limits between the two disciplines been defined (CIANCIO *et al.*, 1981).

The results achieved by the Italian school are worthy of mention, because they are considerable and significant in more than one area. The evolution of forestry thought, as we

have seen, was decisively influenced by theoretical studies and field research on the introduction and cultivation of exotic species. It is a matter that is still being discussed, but that has marked the technical and scientific advance in forestry, making a determining contribution to the development of what has since become an independent discipline: arboriculture for wood production.

Another area that we mentioned earlier is «silviculture on ecological bases». The contributions of ALDO PAVARI and his pupil ALESSANDRO DE PHILIPPIS were determining factors in the cultural development and professional training of several generations of foresters who applied the principles to cultivating forests and to reforestation. An example? PAVARI's phytoclimatic classification and DE PHILIPPIS (1937) control and verification of its validity throughout Italy are milestones for the methods adopted.

The study of coppices has been an extremely important field for evaluating the biological, silvicultural, social and economic aspects of this type of forest cultivation. For a long time forests have been coppiced in our country for the survival of the mountain populations. The Italian school has highlighted its merits (PAVARI, 1935, 1955) and limits (ALBERTO HOFFMANN, 1963; FABIO CLAUSER, 1982): on the one hand emphasising the importance of coppices for wood production and on the other stressing the advantages of converting those coppices that had become degraded due to grazing and fires, and which therefore could no longer guarantee soil protection or assure optimum regeneration.

In this essay, we have mentioned the works of LUCIO SUSMEL several times, especially with regard to the development of «naturalistic silviculture», quantitative ecology and research on uneven-aged forests. Regarding the parallels he drew between uneven-aged and natural structure, one can either agree or disagree. However, one thing is certain: if we

currently know, to a sufficient degree of accuracy, what should be meant by uneven-aged forest, and how it should be treated and arranged to obtain maximum wood production without impacting its function, we owe this knowledge to the originality of his studies.

What then can we say about GENEROSO PATRONE's studies and research in forest economics, forest growth, yield measurement and theories, and mainly differential auxonomy? He, as we have said several times, was a supporter of the even-aged forest. He worked on his studies of «economic and financial silviculture», that is the management of even-aged forests, with great care and perseverance, giving an exemplary contribution from the standpoint of scientific method: he attributed features of universality to those incremental laws which formerly had been mainly expressed in empirical form.

In the preface to his «little treatise», as he defined it, entitled *Elementi di auxonomia differenziale* (1976), PATRONE stated that:

To give rules and uniformities a scientific basis, and a logic that adheres to reality, is the major goal of this work on differential auxonomy, of this study of the laws of the even-aged forest developed with the help of mathematics, and specifically, differential calculus. *Those who fall in love with practice without science, to use Leonardo da Vinci's words, are like the helmsman on a ship without a rudder or compass, who never knows exactly where he is headed.*

In order to know the forest it is necessary to have sufficient knowledge of phytogeography, phytosociology, ecology, zoology, dendrology, mensuration, yield regulation, wood technology, forest economics, etc. And as if that were not sufficient, today, anthropology, sociology, bioethics, etc., are moving into the foreground. To all this we must add the fact that we are going through a phase in which specialised knowledge prevails unrivalled, and «primary» literature is growing geometrically.

This means that the problems of the forest have been studied either on a very small scale, one or just a few trees, or on a very large scale, the territory. In the past few decades the contribution to the development of specialised knowledge has been significant, especially in certain fields including ecophysiology, forest tree genetics and breeding, xylology, ecological landscape planning, remote sensing, inventories, forest harvesting and mechanisation, etc. The knowledge acquired is undoubtedly valuable, but up to now it does not seem able to make a decisive contribution to the resolution of the forestry problem.

We have already highlighted this state of things (CIANCIO and NOCENTINI, 1995a), and while acknowledging the need for specialised research, we emphasise the importance of holistic and systemic forestry research. In other words, we hope that this sectarian and disciplinary attitude will be overcome in favour of multi-disciplinary research:

Specialisation has several advantages, but it also involves two types of difficulties: the first, a tendency to study problems in depth but not in amplitude; and the second, the creation of isolated circuits that are often incapable of communicating with other, even very close, sectors. It is as if to say that specialisations lead to the acquisition of extremely detailed, but not broad, coherent and continuous knowledge. Parcellation of knowledge and the barbarisms of specific scientific disciplines have long impeded the affirmation of the systemic concept. To use a typical forest metaphor, it means that we risk seeing the trees and not the forest. If that is the way things stand, we must make an attempt to fill the gaps in the knowledge we have acquired. We must go beyond the atomistic method of breaking everything down into components and parts. What we have acquired must be recomposed in an organic whole, that is consistent and continuous, following methods aimed at verifying the possibility of helping the vessels of knowledge flow into one another. And this falls into the sphere of the disciplines that look at the synthesis, specifically, silviculture, forest management and economics. These disciplines must not remain closed, huddled into the themselves, they must be open to continuous renewal, even to real regeneration.

In this context, over the past few years the Italian school

has given a definitive thrust to the evolution of forestry thought. The studies concerning the *modular system* in silviculture, which is linked to *forest renaturalisation*, *management on natural bases*, and *systemic silviculture* proposed by ORAZIO CIANCIO and his colleagues, are the object of national and international debate. The fact is that the foundations have been laid for a new way of viewing the forest: no longer as a machine for making wood, but as an entity with a value of its own. It is no longer an object to be bent to the will and desire of man, but a subject with rights of its own.

13.3 – The silvicultural method of yield regulation

There was another turning point in the seventies: MARIO CANTIANI's presentation of the silvicultural method of yield regulation⁽⁵⁾. This method has distant roots: it starts with ADOLPHE GURNAUD's (1890) and HENRY BIOLLEY's (1920) method of control, and extends to ALFRED MÖLLER's *Dauerwald* (1920). It was mentioned by LEON PARDE (1930). But the decisive thrust for its affirmation came from MARIO CANTIANI (1963; 1986) who gave an original and exhaustive interpretation.

In most cases, the structure of our forests has been altered by disorderly use, without any uniform guidelines, due to a lack of regulation plans; they are impoverished of growing stock and present a variability of forms and composition that make it difficult to determine the [most appropriate] silvicultural system. It is obvious that with such disorderly and misshapen forests any attempts at studying the normal forest, ideal for that specific site, would be difficult to carry through. [...] In these cases the application of any regulation method that presumes to calculate the prescribed cut for

(5) For a detailed review of the silvicultural method of yield regulation see CIANCIO *et al.*, (1995).

the whole working section and then distribute it among the various compartments only on the basis of the existing growing stock would be hazardous due to the impossibility – all other considerations aside – of localising the increment solely in relation to volumetric relationships. These problems and pitfalls can be attenuated by applying the silvicultural method which analytically establishes the prescribed cut compartment by compartment according to the specific silvicultural needs of the forest. This method is undoubtedly simple since it does not depend on the study of the normal forest and does not entail lengthy and tiresome elaboration[...]. The forest regulator must, at sight, using concise criteria, determine the percentage of growing stock that can be cut in each compartment and, always on the basis of silvicultural needs, establish the order of urgency of cutting and other cultivation procedures. *Simplicity, versatility and safety* are such important features that the sole defect which can be ascribed to the *silvicultural method*, that of not being able to guarantee the constancy of yield can be relegated to second place (CANTIANI, 1963).

Furthermore, CANTIANI maintained, and thereby entered into conflict with the method's basis, that it can also be extended to «even aged forests», calculating:

[...] the prescribed cut with silvicultural criteria even in the slightly disorderly forests for which it is possible to define the entity of the normal growing stock with sufficient accuracy.

The reason for the rapid spread and application of this method is its simplicity and versatility. It leaves sufficient room for the forester to select silvicultural interventions on a case by case, situation by situation basis. The study of the *normal forest* and the *predetermination of the prescribed cut* are not taken at all into account.

If a summary is possible, we can say that the silvicultural method makes it possible to overturn the concept of economic preeminence in forestry. In this way silviculture becomes

[...] the essential tool for tackling the problems of regulating our forests (CANTIANI, 1963).

The modifications that were later introduced by BERNARDO HELLRIGL (1986) with the prescribed cut being first calculated

for the entire working section, comprise a substantial change in the method.

The silvicultural method represented and still represents an important moment in the development of forestry thought. It influenced the technical-scientific advancement of silviculture, forest regulation and economics: a true cultural revolution, a significant step forward in the field of research. It was a quality leap: the passage from «regulated» to «free» silviculture, with all its implications (CIANCIO *et al.*, 1995).

13.4 – The theory of the modular system

A new awareness was acquired in the nineteen eighties: the forest was now considered less of a resource capable of producing high income and more of an element supporting environmental and cultural values, and only secondly a machine for producing wood. On the one hand the need for preserving the forest for future generations was reaffirmed, on the other there was the birth and development of the systemic view of the forest. Starting from these bases, the theory of the *modular system* (CIANCIO *et al.*, 1981; CIANCIO, 1991) was developed and presented.

This theory is based on the concept that the forest is a system that is never fixed or certain, never completed, and for this reason always on the point of breaking-up and reorganising itself in different forms. The active presence of man is implicit in the system concept, yet he is subject to the restrictions relating to the system's organisation, and dedicated to the preservation of its function.

Each silvicultural intervention affects the forest biocoenosis, leading to modifications that influence the evolutive processes. Each intervention is part of a whole that comprises the system's level of cultivation. The effects become evident

through time and are evaluated in comprehensive terms. In brief, each cultivation intervention is the logical consequence of the preceding one and the basis for the next. The algorithmic concept of the interventions, each of which improves upon and complements the preceding one, summing the effects, is the basic proposition. Biocoenotic reactions are controlled and verified. Following the analysis of these reactions, the technical procedures for the next intervention are defined. In practice, the scientific method of trial and error is followed.

The reaction potential of the biocoenosis in relation to the sequence of caused events and as a function of the relationships between them, must therefore be ascertained. This presupposes that the frequency and level of the interventions are within a range that is defined by the times, modes and features of the recomposition that the stand is capable of achieving as an effect of the reactions of the system. In cultivation terms, this can be translated as *cautious, continuous and capillary* interventions, the three C's of silviculture. They eliminate the lack of balance typical of drastic actions: preventing temporary or permanent collapse of the existing evolutive processes (CIANCIO, 1991).

Even LORENTZ and A. PARADE (1883), according to what TASSY wrote in the preface to the *Cours élémentaire de culture des bois*:

[...] wanted to keep foresters on guard against recklessness.

They advised proceeding slowly, with circumspection, as they themselves had done to improve their Course.

The fundamental elements of traditional silvicultural systems and management methods are the simplification or the transformation of structural types, the rotation, the cutting diameter, the normal growing stock, etc. The reason is simple: classic management methods are tied to purely

financial aspects. On the contrary, the «modular system» does not take into account any of these elements.

The modular system offers a dual advantage: it prevents the creation of conditions that offend the sensibility of those who approach the forest with respect and love; and it tends to identify the system's processes of self-organisation. This is the assumption on which non-linear cultivation modules are based. To have a full awareness of them, it is sufficient to observe, recognise and decode certain bioecological indicators.

The non-linearity of the cultivation paradigm configures a protocol of intents. On the one hand there is the need to read the forest and work intelligently with discretion favouring the maintenance or restoration of the natural forms. On the other, there is the opportunity to break free from the concept of the «normal forest» and to avoid its implications and connections which in practice become rigid planning and excessive schematism. The modular system corresponds to two guiding principles: *systemic silviculture and management on natural bases* (CIANCIO and NOCENTINI, 1994a, b, c, d; 1995a). A forest managed according to these criteria renaturalises itself, it self-organises continuously, and becomes a source of learning and culture.

The unique distinguishing feature of the *modular system* is apparent through an unequivocal datum: while all other silvicultural and forest management forms systematically tend (beyond the specific techniques) to pursue income or specific functions, in this case, the end is different. It differs, for example, from LEIBUNDGUT's *femelschlag* (1946), from SUSMEL's selection forest (1980), from GURNAUD's control method (1890), and from CANTIANI's silvicultural method of yield regulation (1963). The application of the modular system aims at obtaining a forest capable of organising itself independently, and hence the cultivation procedures are only

carried out in the interest of the forest, favouring renaturalisation (CIANCIO and NOCENTINI, 1994a, b, c). No type of financial restriction can or must influence management.

13.5 – Current forest management: the art of the best possible compromise

Forest management is the art of the best possible compromise. This aphorism summarises the complexity of the issue. But, there is more. It includes the technical-scientific contribution towards solving problems related to cultivation, planning and economic analysis of forestry activities. Forest management is correlated with the knowledge, intuition and sensitivity of the forester: it represents the art of forestry.

According to the traditional notions, however, the forest should be managed in such a manner as to assure its conservation, obtain progressive increases in forest product output, and produce high income. If this is the way things stand, we must ask ourselves whether these aspects can be reconciled. To tell the truth, they cannot always be. In fact, today the possibilities of achieving these goals have decreased. And there are valid reasons to believe that they will diminish further in the coming years.

So then, what is required of foresters today? What role should they play? What contributions can they make? The answer is not easy, for several reasons. First of all, forest management is not univocal: it changes in time and space, and even in relation to emergencies. Secondly, it is connected to the type of property and to technological development. Foresters work in exceedingly diverse socio-economic contexts. They must bear in mind that the forest has been recognised as an asset of public interest. At the same time, they must remember that the forest, in the common opinion, is a

renewable resource, and therefore to be exploited, albeit with moderation. This means that the foresters must be skilled in the art of synthesis and be able to move skilfully between opposing and often conflicting requirements.

Therefore, we must ask whether foresters are capable of meeting society's expectations. And if the answer is affirmative, what should their ethical position and behaviour in relation to the forest be? In other words, what form of management should they adopt? A form that considers the forest a commodity? Or, according to a more modern and current notion, a form of management that considers the forest an asset with an intrinsic value? The difficulties lie in this choice – a crucial choice.

13.6 – «Systemic silviculture»

Silviculture is an activity that concerns the object of cultivation, that is, the forest. If we add the adjective «systemic» to the noun «silviculture», it means that the cultivation activity refers to a system, or at least to a subject that is considered such. If the forest is a system, silviculture must take into account the fact that it is subject to the laws to which all systems are subject, no matter what they may be: linguistic system, solar system, ecological system, etc.

The forest consists of a group of parts, the most evident and macroscopic expression of which are the trees. Traditional silviculture has always looked towards them and concerned itself with them, with the purpose of defining cultivation techniques capable of optimising the productive process. This simplification is unacceptable from the ecological standpoint, and it implies a lack of knowledge and consideration concerning how the systems function. This is in spite of the fact that ecosystems are a constant subject of discussion.

A system is an entity comprising many components that are integrated with each other in order that each one's function is the indispensable basis for the functioning of all the others. The system is something more than the sum of its parts. It lives its own life and functions until the integration of its several components is not altered to the extent that the system's internal coherency is compromised.

Silviculture always entails a certain level of artificiality. And yet, the level of artificiality must be contained within certain limits that are acceptable to the forest. How can we identify and define these limits? The definition of limits related to any process presents considerable difficulties. We must follow a dual path: the first regards concepts; the second identifies a technical-scientific method. In this particular case, both the concepts of forest stability and flexibility as well as the *descriptive method* and *trial and error* can be helpful.

Stability, as used here, means the forest's ability to withstand the impact of meteorological, polluting and biotic events. The concept of elasticity is connected to this. Elasticity is a system's ability to react to biotic and abiotic disturbances, re-establishing a new interactive status among its components.

The descriptive and trial-and-error methods are complementary. On the one hand monitoring, controlling and describing the evolution of the system following various types of traumas makes it possible to quantify the intensity of the reaction and the level of wound healing. On the other hand it allows us to define the limits of intervention beyond which the system irreversibly degrades. The modular system we mentioned earlier is based on the application of this method.

What are the propositions for more effective and credible forest cultivation? They can be summarized as follows: to

affirm the principle of the need for cultivating the forest without altering the network connecting the system's various components; to explain that forest management and landscape management are inseparable aspects of the same issue – environment management – and to relate theoretical arguments and real data to prove that the continuous quest for functional efficiency of the forest is the priority objective of management.

However, the markedly innovative proposition is the concept of *systemic silviculture*. This concept is not only an opportunity for theoretical thought, it is also a reminder to evaluate the meaning and value of forestry activities on the basis of the position it assumes in relation to a changed and changing reality. And yet, in order to avoid misunderstandings, we must emphasise that proceeding along theoretical lines does not mean solely developing speculative research, but also, primarily, increasing knowledge of the connective fabric between silviculture in theory and in practice.

The forest is much more than a group of trees. It is a complex biological system. This concept has become the banner that everyone waves whenever the occasion arises: sometimes appropriately, more often inappropriately. *Systemic silviculture* can be configured with man's activity as an essential component of the forest system. This activity, however, must not compromise the organisation and weaken the interactions among the system's several components that are the soul of the forest. And herein lies the difficulty in the forester's task: to define the use of the forest without causing major upheavals in the network of connections that optimise its functionality.

If this is the case, the forest cannot be considered a mere asset or commodity: an object to be bent to the interests of man. On the contrary, it is an entity with an intrinsic value: it is a subject with rights, just like all other living systems. Our

behaviour in relation to it must be respectful. Management must be focused on discreet and specific actions on behalf of the forest. This is not insignificant, it changes the ends. And that is what makes all the difference. But there is more. We must introduce the concept that preservation and conservation are alternative forms of management and as such they have a rightful place among forest sciences. The form of management depends on the system's condition. Passive management is applicable to systems suffering from a high level of degradation. Or, on the contrary, as an aware and well pondered choice if the system has attained its maximum level of functional efficiency. Active management has the goal of renaturalising the cultivated forest. In this case the goal of cultivation is that of triggering processes of self-organisation, autopoiesis, of do-it, or rather, grow-by-yourself. And all this is necessary until the forest acquires the necessary stability, that is, the bioecological efficiency ⁽⁶⁾.

14 – *The culture of complexity*

Through to the nineteen-seventies, forests were approached according to a technocentric concept of exploitation. And the adverse effects are only showing up now. Reductionism distinguished forestry research for a long time. Ecology brutally revealed this simplification. The concept of the forest as a system brings into question the bases of silviculture, of forest economics and management. First it was perceived, then understood and acknowledged that the technical and specialistic approach created schemes that were not

(6) On this subject, see also, «Forest management between ecology, economics and ethics» by CIANCIO and NOCENTINI in this same book.

adequate for understanding the complexity of the forest. In other words, scientific research got bogged down in the swamp of technique for the sake of technique. This is a road which, as experience has shown, is not profitable in the long run.

The current, ongoing debate on the values of the forest is the most evident of all the proofs of this assumption. It is a debate carried on by specialists in different fields: philosophers, theologians, men and women of letters, jurists, economists, biologists, ecologists, anthropologists, historians, geographers, environmentalists, etc. The intent is to extend the objectum of research in an attempt at opening new and broader horizons. The culture of complexity presupposes overcoming academic formalism and sectarianism and hence the parcelling of knowledge. It means recomposing knowledge into a single organic whole; it implies the study and exegesis of non-linear systems.

Today, researchers have enormous means at their disposal. They can develop and apply refined conceptual and operational techniques. They can use sophisticated instruments and tools, but only few foresters have committed themselves to identifying and defining, in theoretical terms, the value system that the forest is gradually acquiring. We can look at the forest in the classic sense and see it – according to the dominant concepts of Cartesian humanism – as an object, an extrinsic or instrumental entity, a machine for producing wood and other commodities. Or, according to another school of thought, we can see the forest as a subject, an entity with an intrinsic value of its own.

In times of transition, and this is one, we must be cautious. We must design the future without forgetting the past. And this is not easy, in fact it is quite difficult. On the one hand it requires clarity of ideas, coherence and logical rigor; on the other it implies a desire to travel new paths

without ignoring the old ones. However, if this is already part of the cultural heritage of some alert spirits who love and respect the forest, it does not seem to be the case in the academic world. It is with great dismay and profound sadness that we report this fact, but as we know, there is no progress without a capacity for self-criticism. The debate on the relative validity of this or that technique, or on the possibility of progress in research asking ourselves, as it is currently customary, what lies behind this or that phenomenon, is, by itself, useless and misleading. We do not want to say that this type of debate should not be continued: today's culture demands it. We must certainly pay attention to specialised research, which can provide confirmations as to the validity of hypotheses and propositions; it can allow us to learn about and develop technologies that were unheard of and unimaginable up to recently; it can allow us to deepen our knowledge on major scientific issues, etc. But if all this is true, it is just as true that mankind today, educated and adept in the use of the most advanced technologies, can no longer be part of the forest ecosystem in an unaware manner, that is like any other consumer. Up to now more or less sophisticated techniques have been applied to forests. They had the most diverse names and labels, but shared a single purpose: to achieve maximum output in the shortest possible time and with the least expenditure of energy, work and capital.

In other words, the end was, and still is, that of acting exclusively on behalf of mankind. The time has come to invert the trend: we must act on behalf of the forest, take action to renaturalise it and promote self-organisation. This is where *systemic silviculture* and *management on natural bases* come into play. This is the «forestry issue» that involves a series of problems. If we want to tackle the forestry issue with awareness, we must, as an old proverb says,

«look ahead and decide immediately». Or, if we prefer, «think globally, and act locally». But perhaps, even better and more appropriate, «look ahead and think big». These maxims contain the key to consciously tackling and resolving a series of problems that had been considered unresolvable. In this lies the wisdom of the forester. If it were not so, we would have to go back to the past. And then we would have to ask ourselves: does the future turn back?

Today, the bases of forest management are being brought into doubt by a series of events and crises. It is simplistic to trace the roots of this situation to merely internal reasons, or solely external social and technological changes. We must redefine the position of forest management. And yet, there is no stand on this issue that is not also – under pain of the sterility in which so many academic circles already live – a position in relation to society as a whole. We are living in historic times in which the neopositivistic view of the world is creaking under the thrust of the culture of complexity. And it is to this culture that the forester must respond if he wants to repropose himself in scientific and technical terms.

Systemic silviculture and management on natural bases are the challenges that foresters must accept, convinced that they are doing something useful for their field and hence their country. Silviculture must be not only a creative act and an opportunity for accepting responsibility, it must also be an opportunity for discussion, and if necessary, cultural clashes to affirm professional competence. In this way we can make a contribution to the development of forestry sciences, the growth of knowledge, the acquisition of an *esprit forestier* or *Waldegessinnung* and above all, the development of a «culture of the forest» without which all the rest is irrelevant. It is the *Zeitgeist*, the spirit of the times, that demands this of us.

REFERENCES

- BAGNERIS G., 1878 – *Manuel de sylviculture*. Berger-Levrault, Paris-Nancy.
- BROILLIARD C., 1881 – *Le traitement des bois en France à l'usage des particuliers*. Berger-Levrault, Nancy.
- BERNETTI G., 1977 – *La selvicoltura naturalistica nella storia del pensiero forestale*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. XXVI: 237-257.
- BETTELINI D., 1986 – *La planification des exploitations ligneuses par la méthode du controle*. Institut fur Wald-und Holzforschung, E.T.H., Zurich.
- BETTELINI D., CANTIANI M.G., 1991 – *Pianificazione forestale in Svizzera: i metodi «classici» di assestamento. Atti dell'incontro di studio sulla pianificazione forestale in Svizzera*. Annali dell'Istituto sperimentale per l'assestamento forestale e l'alpicoltura, Trento, Vol. XII: 281-352.
- BIOLLEY H., 1901 – *Le Jardinage cultural*. Journal forestier suisse, (6): 97-104; (7/8): 113-131.
- , 1920 – *L'aménagement des forets par la méthode experimentale et spécialement la méthode du controle*. Attinger Frères, Neuchatel.
- , 1922 – *L'aménagement des forets*. Neuchatel.
- , 1926 – *L'orientation de l'aménagement des forets en Suisse*. Actes du premier Congrès International de Sylviculture. Rome, 29 avril - 5 mai 1926. Imprimerie de l'Institut international d'Agriculture, Vol. IV: 19-29.
- , 1928 – *La méthode d'aménagement dite «Methode du controle»* Schweiz. Zeitschrift fur Forstwesen 79 (1): 1 -6; 79 (2): 28-35; 79 (3): 58-61.
- BLAIS R., 1936 – *Une grande querelle forestière. La conversion*. Les presses universitaires de France, Paris.
- BOURGENOT L., 1975 – *Futaie régulière ou jardinée? Ou comment traiter les futaies irrégulières*. Revue forestière française, 27 (3): 179-184.
- BROILLIARD C., 1881 – *Le traitement des bois en France à l'usage des particuliers*. Berger et Levarult, Nancy.
- CALVINO I., 1957 – *Il barone rampante*. Einaudi, Torino.
- CANTIANI M., 1962 – *Validità del concetto di «bosco normale»*. In CANTIANI M., BERNETTI G., *Tavola alsometrica delle abetine coetanee della Toscana*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. XI: 293-332.
- , 1963 – *Sviluppi del metodo colturale nell'assestamento forestale*. L'Italia forestale e Montana, 18 (1): 46-48.

- , 1986 – *La determinazione dello stato normale*. In: *Nuove metodologie nella elaborazione dei piani di assestamento dei boschi*. ISEA, Bologna.
- CIANCIO O., 1981 – *I massimi sistemi in selvicoltura*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. XXX: 113-142.
- , 1987 – *Interventi selvicolturali nelle aree protette*. Atti del convegno «Parchi e riserve naturali nella gestione territoriale», Viterbo: 218-232.
- , 1988 – *Il bosco bene di interesse pubblico*. L'Italia Forestale e Montana, 43 (4): 267-270.
- , 1990 – *La gestione del bosco ceduo: analisi e prospettive*. L'Italia Forestale e Montana, 45 (1): 5-10.
- , 1991a – *La gestione dei querceti di Macchia Grande di Manziana: la teoria del sistema modulare*. Cellulosa e Carta, 42 (1): 31-34.
- , 1991b – *La Selvicoltura oggi*. L'Italia Forestale e Montana, 46 (1): 7-20.
- , 1992 – *La questione forestale italiana: l'orizzonte possibile*. L'Italia Forestale e Montana, 47 (6): 321-339.
- , 1993a – *La ricerca scientifica e la formazione per lo sviluppo della selvicoltura e la tutela ambientale*. Gemellaggio Corso di Laurea in Scienze Forestali Palermo-Firenze, Bivona: 100-112.
- , 1993b – *Gli alberi e la città, il bosco e la montagna, simboli e metafore*. L'Italia Forestale e Montana, 48 (6): 384-390.
- , 1993c – *Considerazioni conclusive al 2° Seminario Ricerche ed esperienze nella pianificazione multifunzionale del bosco*. UNIF, ISAFA, AISF, ENEA.
- , 1994a – *Selvicoltura, assestamento, economia forestale... e altro*. L'Italia Forestale e Montana, 49 (3): 232-240.
- , 1994b – *L'arte della ricerca scientifica*. L'Italia Forestale e Montana, 49 (4): 333-335.
- , 1994c – *I diritti del bosco*. L'Italia Forestale e Montana, 49 (5): 445.
- , 1994d – *Nuovi sentieri*. L'Italia Forestale e Montana, 49 (6): 549.
- , 1995a – *Pensiero olistico e pensiero ecologico*. L'Italia Forestale e Montana, 50 (2): 117.
- , 1995b – *La selvicoltura, le anime del forestale, l'interdisciplinarietà e...altro*. L'Italia Forestale e Montana, 50 (2): 244-249.
- CIANCIO O., IOVINO F., NOCENTINI S., 1994a – *The theory of the normal forest. La teoria del bosco normale*. L'Italia Forestale e Montana, 49 (5): 446-462.
- , 1994b – *Still more on the theory of the normal forest: why we insist on saying no to it. Ancora sulla teoria del bosco normale: perché si insiste nel dire no*. L'Italia Forestale e Montana, 50 (2): 118-134.

- CIANCIO O., IOVINO F., MENGUZZATO G., NOCENTINI S., 1995 – *The silvicultural method of yield regulation: a problem of forest cultivation and management. Il metodo colturale: un problema di selvicoltura e di assestamento forestale*. L'Italia Forestale e Montana, 50 (1): 2-19.
- CIANCIO O., MERCURIO R., NOCENTINI S., 1981 – *Le specie forestali esotiche e le relazioni tra arboricoltura da legno e Selvicoltura*. Annali dell'Istituto Sperimentale per la Selvicoltura, Arezzo, Vol. XII: 1-103.
- , 1982 – *La sperimentazione di specie forestali esotiche in Italia - Risultati dopo un sessantennio*. Annali dell'Istituto Sperimentale per la Selvicoltura, Arezzo, Vol. XIII: 105-713.
- CIANCIO O., NOCENTINI S., 1994a – *Gurnaud's control method and silviculture on natural basis: a forest management and silvicultural question. Il metodo del controllo e la selvicoltura su basi naturali: un problema colturale e di gestione forestale*. L'Italia Forestale e Montana, 49 (4): 336-356.
- , 1994b – *La gestione forestale nelle aree protette*. Linea ecologica, 26 (6): 10-13.
- , 1994c – *Problems and perspectives of forest management. Problemi e prospettive della gestione forestale*. L'Italia Forestale e Montana, 49 (6): 550-566.
- , 1994d – *Il bosco: quale forma di gestione?* Atti del convegno «La selvicoltura e i tecnici forestali per la conservazione della biodiversità». (in corso di pubblicazione).
- , 1994e – *La foresta mediterranea: una nuova dimensione*. (in corso di pubblicazione).
- , 1995a – *I nuovi orientamenti in selvicoltura*. In: Giornata di studio sul «Global change», il verde per la difesa ed il ripristino dell'ambiente. 6ª giornata: il ruolo della selvicoltura per la difesa ed il ripristino dell'ambiente. I Georgofili. Atti dell'Accademia dei Georgofili, VII Serie, Vol. XLII: 11-23.
- , 1995b – *Il bosco tra geometrie non-euclidee, fisica classica e complessità*. L'Italia Forestale e Montana, 50 (2): 255.
- , 1995c – *La gestione forestale tra ecologia, economia ed etica*. Il bosco e l'uomo. Accademia Italiana di Scienze Forestali, Firenze.
- , 1995d – *Il paradigma scientifico, la «buona selvicoltura» e la saggezza del forestale*. Il bosco e l'uomo. Accademia Italiana di Scienze Forestali, Firenze.
- CLAUSER F., 1951 – (*Recensione*) *H. Knuchel – Planung und Kontrolle in Forstbetrieb*. Aarau, 1950. L'Italia Forestale e Montana, 6 (5): 266-267.

- CLAUSER F., 1982 – *Sull'evoluzione dei cedui «invecchiati»*. Monti e Boschi, 33 (1/2): 23-25.
- CLEMENTS F. E., 1916 – *Plant succession: An Analysis of the Development of Vegetation*. Carnegie Institution of Washington, Washington.
- COLETTE L., 1960 – *Trente années du contrôle en Hêtraie jardinée*. Stat. Rech. Eaux et Forêts. Serie B, 25, Groenendaal-Hoeilaart.
- COLPI C., 1995 – *Quale selvicoltura? Il bosco e l'uomo*. Accademia Italiana di Scienze Forestali, Firenze.
- COTTA A., 1943 – *Nuovo indirizzo di selvicoltura e sue applicazioni all'agricoltura*. La Rivista Forestale Italiana, 1-2: 43-54.
- , 1952 – *Introduzione alla Fitosociologia*. Annali Accademia di agricoltura di Torino, Vol. 94.
- D'ALVERNY A., 1935 – *Note sur la densité des peuplements jardinés*. Revue des Eaux et forêts.
- DA RIOS G. B., 1922 – *Sulla composizione normale delle fustaie resinose da taglio saltuario*. Atti del I° Convegno Tecnico-Forestale Italiano. Vallecchi, Firenze.
- DEL FAVERO R., 1990 – *Nuovi orientamenti nell'assessamento forestale*. Atti Corso di Aggiornamento Professionale Quadrifoglio Dolomiti, Belluno, 79-89.
- DE LIOCOURT F., 1898 – *De l'Aménagements des Sapinières*. Bulletin Société Franche Comté et Belfort.
- DENGLER A., 1930 – *Waldbauauf ökologischer Grundelage*. Berlin.
- DE PHILIPPIS A., 1937 – *Classificazioni ed indici del clima in rapporto alla vegetazione italiana*. R. Stazione Sperimentale di Selvicoltura. Ricci, Firenze.
- , 1950 – *Selvicoltura libera o regolata? L'Italia Forestale e Montana*, 5 (1): 43-47.
- , 1967 – *La selvicoltura di fronte al crescente fabbisogno di prodotti legnosi*. L'Italia Forestale e Montana, 22 (3): 140-151.
- , 1970 – *Governo e trattamento dei boschi: dall'insegnamento di Vallombrosa alla realtà di oggi*. L'Italia forestale nel centenario della fondazione della scuola di Vallombrosa. Accademia Italiana di Scienze Forestali, Firenze.
- , 1972 – *Ecologia e selvicoltura: antitesi o armonia? L'Italia Forestale e Montana*, 27 (3): 104-120.
- DI BÉRENGER A., 1859-1863 – *Dell'antica storia e giurisprudenza forestale in Italia*. Longo, Treviso e Venezia. *Studi di Archeologia forestale*. Ristampa in foto-lito, 1965, Firenze.
- DIETRICH V., 1941 – *Forstliche Betriebswirtschaftslehre*. Bd. III, Erfolgsrechnung, Zielsetzung. Parey, Berlin et Hamburg.

- DI TELLA G., 1924 – *Metodi di coltura e di assestamento forestale: a proposito di una nota bibliografica*. L'Alpe, 11 (12): 357-361.
- , 1926 – *I principali tipi di boschi italiani. La tecnica del loro governo e trattamento*. Italia Forestale, Firenze.
- DRALET M., 1820 – *Traité des forêts d'arbres résineux, sur les montagnes de France et terrains adjacents*. Vieusseux, Toulouse.
- ENDRES M., 1911 – *Lehrbuch der Waldwertrechnung und Forststatik*. Berlin.
- , 1922 – *Forstpolitik*. Berlin.
- EVELYN J., 1662 – *Sylva: Or a Discourse of Forest-Trees and the Propagation of Timber in His Majesty's dominions*. London (in Harrison, 1992).
- FAVRE E., 1931 – *Nouvel exemple d'aménagement par la méthode du contrôle*. Mitteilungen der Schweizerischen Centralanstalt für das forstliche Versuchswesen, XVII Band, 1^o Heft.
- , 1943 – *Cinquante années d'application de la Méthode du contrôle à la forêt de Couvet*. Journal forestier Suisse.
- FAVRE L. A., 1983 – *Plan d'aménagement des forêts communales de Couvet*. Dattiloscritto in possesso del Servizio forestale cantonale, Neuchatel.
- , 1989 – *L'évolution des forêts au Val de Travers: de l'exploitation abusive à la sylviculture naturelle*. Fondation Sophie et Karl Binding, Bale.
- FONTAINE R., 1966 – *Pianificazione e assestamento forestale*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. XV: 323-340.
- FRANÇOIS T., 1938 – *La composition théorique normale des futaies jardinées de Savoie*. Revue des Eaux et Forêts.
- FRÖHLICH J., 1947 – *Les enseignements de la forêt vierge*. Journal forestier suisse, 318-323.
- GALOUX A., 1953 – *Contribution à l'étude de la futaie de chêne jardinée par bouquets*. Groenendaal.
- GAYER K., 1901 – *Traité de sylviculture*. Traduzione da «Waldbau», Berlino, 1889 (seconda edizione), Bruges.
- GIACOMINI V., 1964 – *Equilibri biologici e produttività biologica delle foreste*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. XIII: 17-35.
- GIDDENS A., 1990 – *The Consequences of Modernity*. Stanford University Press, Stanford.
- GURNAUD A., 1884 – *La sylviculture française*. Jacquin, Besançon.
- , 1886 – *La sylviculture française et la méthode du contrôle*. Jacquin, Besançon.

- , 1890 – *La méthode du controle et la tradition forestière*. Revue des eaux et forets: 209-218.
- HARRISON POGUE R., 1992 – *Forests: the shadow of civilization*. University of Chigago Press.
- HELLRIGL B., 1986 – *I compiti dell'assestamento forestale*. In: *Nuove metodologie nella elaborazione dei piani di assestamento dei boschi*. ISEA, Bologna.
- HELLRIGL B., 1986 – *La determinazione della ripresa*. In: *Nuove metodologie nella elaborazione dei piani di assestamento dei boschi*. ISEA, Bologna.
- HOFMANN A., 1924 – *L'assestamento dei boschi comunali*. L'Alpe, 11 (9): 265-271.
- , 1925 – *Un giudizio sul bosco permanente del Möller*. L'Alpe, 12 (2): 37-38.
- , 1926 – *Il bosco permanente e l'assestamento forestale*. Actes du premier Congrès International de Sylviculture. Rome, 29 avril-5 mai 1926. Imprimerie de l'Institut international d'Agriculture, Vol. IV.
- HOFMANN A., 1957 – *Contributo ad una selvicoltura su basi naturalistiche*. L'Italia Forestale e Montana, 12 (3): 105-111.
- , 1963 – *La conversione dei cedui di faggio*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. XII: 145-167.
- HUFFEL G., 1926 – *Economie forestière*. Troisième édition. Paris.
- KNUCHEL H., 1950 – *Planung und Kontrolle in Forstbetrieb*. Aarau.
- KÖSTLER J.N., 1950 – *Waldbau. Grundriss und Einführung als Leitfaden zu Vorlesungen über Bestandesdiagnose und Waldtherapie*. Parey, Hamburg e Berlin.
- , 1958 – *Problemi delle fustaie da dirado a Nord e a Sud delle Alpi*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. VII: 178.
- KUHN T.S., 1970 – *The Structure of Scientific Revolutions*. The University of Chicago.
- LANIER L., 1986 – *Précis de sylviculture*. E.N.G.R.E.F., Nancy.
- LEIBUNDGUT H., 1946 – *Femelschlag und Plenterung*. Journal Forestier Suisse, 97 (7): 306-317.
- , 1960 – *Risultati delle ricerche in foreste vergini europee*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. IX: 277-287.
- , 1966 – *Die Waldpflege*. Haupt, Bern und Stuttgart.
- , 1982 – *Europäische Urwälder der Bergstufe*. Haupt, Bern und Stuttgart.
- , 1984 – *Die Waldpflege*. Haupt, Bern und Stuttgart.

- LEMMEL H., 1937 – *Der Dauerwaldgedanke und das eiserne Gesetz des Oertlichen*. D. dt. Forstw.
 –, 1939 – *Die Organismusides in Möllers Dauerwaldgedanken*. Berlin.
- LORENTZ B., PARADE A., 1883 – *Cours élémentaire de culture des bois*. Sixième édition publiée par A. LORENTZ et L. TASSY. Octave Doin, éditeur, Paris.
- MAGINI E., 1973 – *Il miglioramento delle piante forestali in Italia*. Monti e Boschi, 24 (1): 15-24.
- MANWOOD J., 1717 – *Manwood's Treatise of the Forest Laws*. London. E. Nutt, 4a ed. (in Harrison, 1992).
- MARSH G.P., 1993 – *L'uomo e la natura. Ossia la superficie terrestre modificata per opera dell'uomo*. Ristampa. Angeli, Milano.
- MAYER H., 1977 – *Waldbau auf soziologisch-ökologischer Grundlage*. Stuttgart-New York.
- MAYR H., 1909 – *Waldbau auf naturgesetzlicher Grundlage*. Parey. Berlin.
- MC QUILLAN A.G., 1990 – *Is national forest planning incompatible with a land ethic?* Journal of forestry, 88 (5): 31-37.
- MIEGROET (VAN) M., 1961 – *Betrachtung zur heutigen Dualität der Waldbaulichen Auffassungen*. Journal Forestier Suisse, 1.
- MÖLLER A., 1922 – *Der Dauwerldgedanke. Sein Sinn und seine Bedeutung*. Berlin.
- MUZZI S., 1970 – *Vicende storiche della scuola forestale italiana*. L'Italia forestale nel centenario della fondazione della scuola di Vallombrosa. Accademia Italiana di Scienze Forestali, Firenze.
- OFFICE NATIONAL DES FORÊTS, 1970 – *Manuel d'aménagement*. Paris.
- OTTO H-J., 1990 – *Données écologiques et objectifs d'une sylviculture proche de la nature*. La forêt privée, 196: 37- 43.
- PARADE A., 1883 – *Cours élémentaire de culture des bois*. Sixième édition publiée par A. LORENTZ et L. TASSY. Octave Doin, éditeur, Paris.
- PARDE L., 1930 – *Traité pratique d'aménagement des forêts*. Paris.
 –, 1991 – *La méthode du controle, d'hier à aujourd'hui*. Revue Forestière Française, 43 (3): 185-201.
- PATRONE G., 1944 – *Lezioni di assestamento forestale*. Firenze.
 –, 1965 – *Programmazione lineare in selvicoltura*. Firenze.
 –, 1970 – *Il contributo tecnico scientifico della scuola forestale italiana dal 1869 al 1924*. L'Italia forestale nel centenario della fondazione della scuola di Vallombrosa. Accademia Italiana di Scienze Forestali, Firenze.
 –, 1972 – *Stravaganza prima: l'essenza dell'assestamento forestale*. L'Italia Forestale e Montana, (27) 1: 1-22.

- , 1975 – *Ricerche sulla fustaia disetanea del Cadore*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. XXIV: 29-109.
- , 1976 – *Elementi di auxonomia differenziale*. Accademia Italiana di Scienze Forestali, Firenze.
- , 1979 – *Stravaganza terza; la fustaia da dirado: realtà o fantasma?* Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. XXVIII: 267-306.
- , 1980 – *Stravaganza quarta: la preminenza dell'economia sull'assessamento e la selvicoltura*. L'Italia Forestale e Montana, 35 (3): 116-125.
- , 1981 – *Stravaganza quinta e somma - Un avanzo poco conosciuto del protocosmo: la foresta*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. XXX: XIX-XL.
- PAVARI A., 1916 – *Studio preliminare sulle colture di specie forestali esotiche in Italia*. I. Parte generale. Annali del R. Istituto Superiore Forestale Nazionale.
- , 1921 – *Studio preliminare sulle colture di specie forestali esotiche in Italia*. II. Parte descrittiva. Annali del R. Istituto Superiore Forestale Nazionale.
- , 1929-30 – *Lezioni di Selvicoltura generale e speciale*. Tipo-Lito Filippini, Firenze.
- , 1932 – *Lineamenti di selvicoltura comparata su basi ecologiche*. Atti della Reale Accademia dei Georgofili, V Serie, Vol. XXIX.
- , 1935 – *I cedui nella selvicoltura italiana*. L'Italia Agricola.
- , 1938 – *Selvicoltura naturalistica e selvicoltura autarchica*. Atti della Reale Accademia dei Georgofili, VI Serie, Vol. IV.
- , 1946 – *Orientamenti e problemi della selvicoltura italiana*. Atti del Convegno Agrario Italo-Americano, Firenze.
- , 1953 – *Governo e trattamento dei boschi*. R.E.D.A., Roma.
- , 1954 – *Basi ecologiche e tecniche della selvicoltura nei paesi mediterranei*. Monti e Boschi, 10: 435-452.
- , 1955 – *Il problema dei boschi cedui*. Monti e Boschi, 6 (8): 339-350.
- , 1959 – *Basi ecologiche della selvicoltura europea*. Scritti di ecologia, selvicoltura e botanica forestale. Accademia Italiana di Scienze Forestali, Firenze.
- , 1959 – *Su alcuni principii di ecologia forestale*. Scritti di ecologia, selvicoltura e botanica forestale. Accademia Italiana di Scienze Forestali, Firenze.
- , 1959 – *Basi ecologiche e tecniche dei rimboschimenti in Italia*. Scritti di ecologia, selvicoltura e botanica forestale. Accademia Italiana di Scienze Forestali, Firenze.

- , 1959 – *La restaurazione forestale dei terreni nudi nel bacino Mediterraneo*. Scritti di ecologia, selvicoltura e botanica forestale. Accademia Italiana di Scienze Forestali, Firenze.
- PAVARI A., DE PHILIPPIS A., 1941 – *La sperimentazione di specie forestali esotiche in Italia. Risultati del primo ventennio*. Annali della Sperimentazione Agraria, Failli, Roma, Vol. XXXVIII.
- PERONA V., 1895 – *Di alcuni metodi per determinare le riprese dei boschi da taglio saltuario*. L'eco dei campi e dei boschi, Roma.
- , 1905 – *Economia forestale. Selvicoltura generale*. Vallardi, Milano.
- , 1914 – *Economia forestale. Dendrometria*. Vallardi, Milano.
- POCKBERGER J., 1952 – *Des naturgemässe Wirtschaftswald als Idee und Waldgesinnung*. Wien, Verlag Georg Fromme.
- PRESSLER M., 1865 – *Das Gesetz der Stammbildung*. Leipzig.
- ROMANELL P., 1969 – *Il naturalismo critico*. Taylor, Torino.
- SCHÄDELIN W., 1937 – *L'éclaircie. Traitement des forêts par la sélection qualitative*. Attinger, Neufscâtel.
- SCHAEFFER A., 1900 – *Un type de futaie jardinée*. Bulletin de la Société forestière de Franche-Comté et Belfort.
- , 1908 – *Accroissement d'un massif jardiné*. Bulletin de la Société forestière de Franche-Comté et des Provinces de L'Est, Tome IX: 433.
- SCHAEFFER A., GAZIN A., D'ALVERNY A., 1930 – *Sapinières. Le jardinage par contenance (Méthode du Contrôle par les courbes)*. Les Presses Universitaires de France, Paris.
- SCHAEFFER L., 1931 – *Sur trois modes de calcul de la possibilité des futaies jardinées*. Annales de l'École Nationale des Eaux et forêts et de la Station de Recherches et Expériences Forestières, Tome IV, fascicule 1. Berger-Levrault, Libraires-Éditeurs, Nancy-Paris-Strasbourg.
- , 1945 – *Gurnaud et le jardinage*. Livret du cinquantenaire de la Société forestière de Franche-Comté: 227-259.
- SCHÜTZ J. PH., 1989 – *Sylviculture 1. Principes d'éducation des forêts*. Presses polytechniques et universitaires romandes, Lausanne.
- SCHÜTZ J. PH., 1991 – *Tendances actuelles de la sylviculture en Europe occidentale*. Comptes rendus de l'Académie d'agriculture de France, Vol. 77 (8): 3-14.
- SMUTS J., 1926 – *Holism and Evolution*. Mac Millan, New York.
- SUSMEL L., 1955 – *Riordinamento su basi bioecologiche delle abetine di S. Vito di Cadore*. Stazione Sperimentale di Selvicoltura, Firenze.
- , 1956 – *Caratteri comparati delle abetine primarie delle Alpi Dinariche e delle abetine secondarie delle Alpi italiane*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. V: 115-146.

- , 1957 – *Caratteri ecologici, vegetativi e strutturali dei boschi di Longarone*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. VI: 21-129.
- , 1959 – *Riordinamento su basi bioecologiche delle faggete di Corleto Monforte*. Stazione Sperimentale di Selvicoltura, Firenze.
- , 1962 – *Selvicoltura naturalistica e selvicoltura agronomica*. Agricoltura delle Venezie, XIV: 241-265.
- , 1964a – *Piano colturale della foresta demaniale di Collina (Pistoia)*. Annali del C.E.M.V., Vol. IV, CEDAM, Padova.
- , 1964b – *Limiti e problemi degli attuali indirizzi selvicolturali*. Monti e Boschi, 15 (2): 3-14.
- , 1970a – *Dove va la selvicoltura?* Monti e Boschi, 21 (2): 3-8.
- , 1970b – *Guida alla definizione dello stato normale per i principali boschi della Regione Trentino-Alto Adige*. Padova.
- , 1972 – *Ecologia*. Parte prima: *Fattori ecologici*. Padova.
- , 1973 – *Ecologia*. Parte seconda: *Ecosistemi*. Padova.
- , 1976 – *Possibilità della selvicoltura artificiale nella regione mediterranea*. Monti e Boschi, 27 (4): 3-17.
- , 1979 – *Modello strutturale di abetine e peccete primarie*. Atti Ist. di Ecologia e Selv., Padova, Vol. I.
- , 1980 – *Normalizzazione delle foreste alpine*. Liviana, Padova.
- , 1986a – *Prodromi di una nuova selvicoltura*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. XXXV: XXXIII-LI.
- , 1986b – *Selvicoltura naturalistica ed economica*. Economia Montana, (6): 16-17.
- , 1988 – *Principi di Ecologia*. CLEUP, Padova.
- SUSMEL L., VIOLA F., BASSATO G., 1976 – *Ecologia della lecceta del Supramonte di Orgosolo*. Annali del C.E.M.V., Vol. X, CEDAM, Padova.
- TASSY L., 1886 – *Lorentz et Parade*. Paris.
- , 1887 – *L'Aménagement des forêts*. 3 Ed., Paris.
- WAGNER C., 1923 – *Die grundlagen des Räumlichen Ordnung in Walde*, IV edizione, Tubinga.

Antonio Gabbrielli

THE FOREST BEFORE SILVICULTURE

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The practice of silviculture, intended as the rational cultivation of the forest with the purpose of maintaining and improving it as well as conserving the efficiency and continuity of the ecosystem, reached Italy rather late.

A forestry technician of great value who passed away some time ago asserted that even at the beginning of the fifties Italian forests were passing through a phase of «exploitation», as if to say that silviculture in the true meaning of the term was yet to come.

For centuries just an appendix of agriculture and its integration, the forest has in recent times broken free from this situation. This happened precisely when mountain and hill agricultural economy was floundering and farm crops consequently gave way again to forest stands. In other words, the forest is regaining (according to the laws of nature and with the aid of man) the land from which it had been dislodged by the rural population (which in the past accounted for 70% of the active population).

The forest-grazing association, consolidated over thousands of years (suffice it to consider the ancient Italic civilisation, known as the «Apennine civilisation»), was perhaps the least conspicuous form of utilisation and, at first sight, the least burdensome for the forest. However, practised year-round and over a long period of time, it became one of the main causes of forest decline, especially with the advent of various new felling techniques. An axiom, frequently recurring among foresters who have worked in areas where grazing was the main factor in a meagre agricultural economy,

was that where there was grazing one should not cut, and where there was cutting one should not graze. However, this was easier said than done, because compromise has always been necessary.

Apart from grazing, the large forests which once covered the Italian plains served as a «reservoir» of land that was slowly used up for agriculture. Many land reclamation projects were carried out with this aim, including the famous ones implemented by the Benedictine monks in the Po Valley (Nonantola, Chiaravalle, Polirone and Pomposa), along the Volturno river (San Vincenzo al Volturno), and in this century, in the Pontine Marshes.

Finally, the most striking aspect of «exploitation» was the cutting of trees and undergrowth for both civic usage and share tenancies, which for centuries gave the forest no respite. Perhaps the only institutions practising a more rational utilisation of resources, forests included, were the so-called «Regole» (or precepts) of the Trento and Cadore districts. In any case, those mountain people made a virtue of necessity because, if the forest disappeared, they too would have died. Even selection felling, which at first went under the name of «cadorino», was more commercially than silviculturally oriented.

Added to the agricultural uses of the forest (grazing, firewood, brushwood and litter gathering, and last but not least, chestnut cultivation) were, since the early Renaissance, civilian and military uses consequent to a marked expansion in building and manufacturing and to the increasing power of the seigniories. For at least three centuries, the forest was treated as a «green mine» from which as much material as possible was extracted, with little or no thought for the future.

But the alarm sounded just a little later, when it was realised that owing to progressive decline the forest could no

longer efficaciously protect soil from erosion, one of its oldest basic functions. Classical examples of this concern were Venice and Florence, the former intent on preventing the lagoon from being filled and the latter on preventing the flooding of the city.

By the beginning of the sixteenth century, the forest had started to claim the status of asset of public interest. Indeed, here and there throughout Italy many laws and regulations dedicated to the safeguarding of forests were being promulgated. Economic and social aspects were taken into account: the aim was to avoid shortages of timber and firewood, keep up soil protection and control river flow rates so that water could also be used for irrigation.

At the same time knowledge in forestry matters was increasing, thanks to direct experience and to importation from other countries, mainly Germany. It evolved very slowly, giving use to ever more accurate techniques which were sensitive to the future of the forest, and led to the development of what we know today as silviculture.

Giovanni Bovio

FOREST AND LAND

FOREST AND LAND

1 – In Italy, where the environment changes considerably with the latitude and altitude, forestry operations can differ greatly.

Environmental and socio-economic requirements might indeed recommend very different ways of approaching the forest: making it even- or uneven-aged; managing it with a strictly pre-established allowable cut or else determined on the basis of silvicultural criteria at the moment of intervention; leaving it to natural evolution or concentrating on wood product by turning to tree farming. The distribution of the forest over the land is closely related to the various activities (agriculture, industry, services). In correct forest management, these must be carefully considered. This is particularly important near urban areas or in parks, but also, (though at a different level) in vast areas in Italy where no intervention is carried out and abandon is the outcome.

There are no simple solutions to avoid the lack of interest regarding the forest. However, I believe that a deeper knowledge of the land in all its aspects is of great help in interpreting the present situation.

There is a need to compare the forest-organism with the society-organism so as to clarify whether one should intervene or not, whether silviculture should be carried out and, if so, how. This knowledge is the instrument at the base of forest planning. A stimulus to more thorough study may stem from laws promulgated to safeguard the landscape, biodiversity or protected areas.

I, therefore, believe that it is necessary to analyse the relationship between the importance society attributes to the for-

est, its cultivation and its distribution over the territory, underlining how socio-economic aspects influence the choice between intervening in the forest or abandoning it.

2 – Knowledge of forest distribution over the land is the first presupposition for its management.

In ancient times, man had already searched for a spatial identity, humanising in various ways forest areas which were perceived as hostile. The determining of spatial location has always come about by delimitation, using significant boundary elements in the landscape (LAGAZZI, 1988). There are many boundary marks which were already in use in ancient Roman times: the *limites* made out of stones (terminals as we know them), the *cippus*, or other more common ones, linking up with the road network, or else referring to natural elements such as those containing water.

These material forms describe the collocation of forests, highlight their productive worth, recognise the human activity behind them and have always been correlated to the type of ownership.

Physical delimitation, once the only way of really finding out the location of the forest, may appear less important today because the instruments used for describing the land have meanwhile been improved. Large-scale topographical maps can be obtained from aerial photographs or satellite images and the exact situation of forest cover can thus be ascertained. Geographic Informative Systems offer the possibility of describing the forest complex in its most detailed aspects.

3 – Man's interventions have, over the course of centuries, characterised forest landscapes, moulding them according to their own history and features.

Besides the differences which derive from human action, there are those consequent to environmental variables, which can show even considerable diversification between not very distant areas.

In rural and forest areas, furthermore, multiple activities intersect. Despite the abandonment of mountain areas, resulting in a decrease in resident population, human activity (electric lines, roads, railways, etc.) continues to spread. This fact is extremely important in Italy, where the population density is among the highest in Europe. In looking after the forest, foresters have to operate increasingly in harmony with agronomists, naturalists and town planners. This need derives chiefly from the changed relationship with the forest as compared to the past.

4 – The space occupied by the forest has always been contended by other activities.

This happened principally with agriculture and grazing which have evolved, occupying wide tracts. More recently, because of changes in farming and grazing techniques or because these activities have stopped altogether, the forest has begun to expand again. The distribution of various forest species has been influenced by these events. Larch, characterised by a high ecological plasticity for a long time has tolerated disturbance from grazing; once this has ceased, larch is spreading again as a pioneering species in many mountain areas. Another similar example is that of Scots pine. Many xeric environments, for centuries exploited by agriculture and consequently impoverished, have been colonised by pubescent oak.

Other variations in the forest cover are related to exploitation or the lack of management operations. Swiss stone pine (*Pinus cembra* L.), which suffered a setback owing to the

heavy demand for its wood, is, today, spreading again. Where the forest had been transformed to make room for sweet chestnut groves, there is a return to the initial situation when chestnut cultivation ceases.

Afforestation, widely practised chiefly to limit environmental degradation, causes changes in the landscape, which are very evident if exotic forest species are planted. If native species are employed, these plantations can be considered as a sort of environmental restoration (PIGNATTI, 1994), even if this objective is rarely reached. Indeed, species are often planted even where environmental characteristics would advise against it. An example is spruce which has been spread even to the detriment of common beech.

The evaluation of variations in the landscape and in the productive aspect imposes an exact knowledge of the distribution of forests over the land and their current and potential characteristics.

5 – The expediency of cultivating the forest must be examined from both the economic and financial viewpoints.

As public and private owners do not share the same objectives, silvicultural operations will be different in the two cases. If there is no financial advantage, the private owner in particular tends to abandon forest cultivation to pursue other more lucrative ends.

After past shrinkage, the forest today is extending and occupying those areas where it had once been destroyed. This is the result of spontaneous dissemination which does not come from economic incentives, but from the abandonment of other activities, such as agriculture, in turn abandoned because no longer profitable. This new «invading forest» is not subjected to any silvicultural intervention.

Public and private owners pursue different goals. Public

owners can cause the forest to spread and maintain it also with the objective of obtaining not only production but externalities as well. In planning activities in forest management for a specific area, forests should be classified according to their general interest so as to establish where a priori action is to be taken. Recent research has come up with a method which allows the evaluation of the economic quality of the forests in a district, using an ordinal criterion and avoiding monetary assessment (GIAU and FURLAN, 1994). These methods may be used in forest and land planning, especially at the intermediary level between regions and municipalities (GIAU and FURLAN, 1993).

6 – The position of the area within a certain territory may be more or less favourable to cultivation prevalently aimed at timber production.

Recently there has been an increase in the tendency of many entrepreneurs to plant tree farms using species that produce high quality timber (BURESTI and FRATTEGANI, 1994). These are temporary, reversible plantations because at the end of the productive cycle the owner's aims may change. The economic prospects of this type of cultivation are encouraging, but in order to achieve positive results, precise technical rules must be respected.

Tree farming for timber production is frequently justified by extra-economical considerations and subsequently it often does not offer opportunities for high returns (PETTENELLA, 1994).

In this case as well, the characteristics of the forest cover are closely correlated to the location on the territory. This type of cultivation is possible only where specific and intensive operations can be carried out.

7 – At times, interventions of an extensive nature are

envisaged so as to optimise the forest's capacity to shelter wildlife.

Animals occupy different areas depending on the species and environmental conditions. They may also cause damage if there is no correct proportion between their needs and the possibility of satisfying them. Many species spread over very vast areas, while others prefer smaller areas with definite characteristics. Therefore, the forest can normally be managed in relation to wildlife only over wide areas. Operations must be carried out in all the places where the animals move throughout the course of the seasons in the fulfilment of their vital functions.

Knowledge of the distribution of the forest over the land cannot be ignored when considering wildlife management because any variation in forest structure or surface may interfere with the animal population.

8 – The forest is an environment with great biological wealth and diversity.

For this reason, there are laws and regulations both to defend threatened species and environments of particular value and to minimise the consequences of anthropic intervention on the forest, thus safeguarding its biodiversity. The European Community has issued regulation n. 92/43 for the protection of natural flora and fauna habitats in Europe.

Once we start talking about the conservation of the biological heritage, the concept of biodiversity emerges. This deals with ecosystems and species diversities, and also with genetic differences within the same species.

Diversity can be conceived as the possibility of dividing the components of a group into different classes (PIGNATTI, 1994). The same concept of biological diversity means that all living species deserve the same attention.

The individuals which make up a system interact, maintaining their individuality. The ecosystem therefore assumes collective characteristics without losing those of its components. Biological diversity should be at a maximum where no single species clearly dominates all the others (GIANNINI, 1994). The land scale over which operations are carried out determines the level of diversity, ranging from the level of the species to that of the landscape.

Biodiversity can be favoured by limited intervention and perturbations on the ecosystem. It may be depressed by intense perturbations. What kind of intervention can be carried out in the forest in order not to reduce biodiversity? Not always does maximum wood production correspond to high specific diversity. Are we willing to sacrifice a part of biodiversity in order to increase production, and if this is the case, how much of a decrease can we accept?

I believe that biodiversity must be maintained, if not increased, in order to ensure the productive function in the long term, together with soil protection, landscape enhancement and recreational value. The operational choice is very difficult. Indeed, some silvicultural and management interventions favour biodiversity; others less so.

It has been seen that the conversions of beech coppices to high forest has caused an impoverishment of biological diversity (FLAMMARION, 1993). On the contrary, coppices under high forest maintain various ecological niches and, at the same time, provide an ideal habitat for wildlife because they produce a high biomass for browsing and offer the possibility of shelter.

Biodiversity is the consequence both of the environment and of man's intervention. It is related to the number of species but also to the forest structure, and to how this varies in space, whether vertically or horizontally.

Pursuing biodiversity means making sure that all the con-

ditions suitable for the multiplicity of the animal and vegetal species of the forest exist.

Furthermore, diversity does not depend only on the number of species present, but also on the reciprocal relationships between them and the available space. It is, consequently, necessary to know the distribution of forest formations.

Diversity is also reflected at the landscape level due to the changes in the forest complex as the consequence of silvicultural operations and management.

The criteria for maximising biodiversity should be pursued everywhere, following a scale of priorities which gives precedence to particular situations such as parks.

9 – The environmental issue originated when production, in general, became a central feature and it was perceived that the relationship with nature was becoming difficult and conflicting at times.

On the one hand, man has the sensation that he dominates the world, on the other he is afraid of affecting the environment negatively and irreversibly. For having ravished it and for being aware of this, we bear a diffuse sense of guilt today. We have become aware that our action against nature is too heavy-handed and that nature is in danger of being destroyed by the «bad» side of man that produces and seeks prosperity.

The attention devoted to nature over the past few years is, at the same time, a symptom of unease and a proposal for analysis and solutions. The environment has become an important point of reference, especially since the eighties, and the forest is at the centre of attention. Whether silvicultural intervention is called for or whether the forest is left to evolve naturally, choices must be made today which derive from the analysis and the knowledge both of the cultural and silvicultural situation. In this way, the forester is no longer

the feared predator of the forest, but the interpreter of the social needs which distinguish each tract of land.

The concept of caring for the forest by trying to balance use and conservation was introduced in the National Forest Plan. More recently, the focus has shifted to the «restoration» of the forest, that is mainly the conversion of coppices to high forests, also with aim of creating jobs.

As trends change and with them the consequent approach to the forest, the forester must propose management lines which respect every social conviction. All the same, the ends of man must not prevail over the needs of the forest. It is precisely because of this that he cannot determine cultivation patterns (CIANCIO, 1991). This means assuming an advanced approach which can be put into practice immediately in some areas of our country, but perhaps not everywhere, because there is a multiplicity of situations and all of them have particular characteristics.

All other conditions being equal, forests vary in relation to the location that man grants them.

The evolution in the social approach to the forest has induced changes in its aims and distribution. In some geographical and economic areas it is desirable that the forest offer products and externalities and this is the object pursued by management.

Theory, ethical criteria with which to approach the forest, technical means, laws and regulations are evolving. There are some who maintain that social evolution which brought women onto a par with men has led to less aggressive relationships with the forest, more respectful than in the past. This is due to the spread of the feminine ability to face problems in a more instinctive and less utilitarian way.

Perhaps even in the near or even distant future, the main criteria might change and we will witness the generalisation of an approach where the forest system identifies itself in

man and man identifies himself in nature, thus also enhancing the economical aspects connected with the forest (CIANCIO and NOCENTINI, 1994).

All these changes demand knowledge of the territorial characteristics which govern intervention. Knowledge of the territory is the basis for forest planning which makes use of modern means without, however, ignoring those of the past. I believe that yield regulation methods born in the past are still applicable, although not in the same strict way as previously.

The entity of the allowable cut can be derived by reasoned planning and, if necessary, can be converted into numbers by the most appropriate of the many arithmetical formulas that characterise the various yield regulation methods. In any case, the results must not be more than an indication that the forester uses to evaluate forest evolution following operations. What was called normal yesterday is seen as the ideal situation today. Evolution towards this ideal situation can be favoured by appropriate silvicultural operations. Forest cover must not be forced into predefined models, but we must also discard what we are not able to schematise.

10 – We could conclude that the difficulty to overcome is understanding the logical connections between the microscopic and the macroscopic, between man, nature and economics.

The opinions and choices of the individual can be influenced, even greatly, by the environment in which he lives, and so the way the forest is perceived may vary considerably. To a certain extent, choices depend on the environment and land organisation. Individual preferences may also be conditioned by choices of forestry policy. Accordingly, the conservation of the environment may be interpreted in many, even subtly, different ways.

In order for all the functions of the forest to be fulfilled, spontaneous forest stability must not be upset.. This is often intended as a «non-change» of the current situation or as a known change. Everything which varies in an unknown way is, for convenience, often defined as unstable (VIOLA, 1994).

Forest regulation supersedes the concept that the territory must be invariable if it is to be conserved. «Dynamic perpetuation» (HELLRIGL, 1986) takes place in the whole block or working cycle if the fundamental characteristics of the forest are maintained constant, while the older individual trees are periodically replaced by young ones. In the same way, «dynamic conservation» (PIGNATTI, 1994 *op. cit.*) of an area occurs if a local modification is not followed by changes in the entire area. In this way, the concept of perpetuation does not clash with that of dynamism and intervention, on the condition that on the whole landscape is not considerably altered, and its entropy remains constant. Entropy variations increase disorder in the ecosystem with the consequent decrease in available energy (PIGNATTI, 1994 *op. cit.*). Intervention in the forest must aim at maintaining the entropy level reached or, if necessary, lowering it, thus increasing available energy. The entropy may, accordingly, be increased in specific areas and diminished in others, but it should remain unchanged on the territory as a whole.

These concepts are fundamental in forest planning. They are just as important in ecological planning (theorised by Mc HARG in 1969) and in the derived forms of naturalistic and environmental planning (SAINI, 1985). All share the prevalence of the ecological aspect over the economic objective as a common denominator.

The progress of forestry as a science depends on the understanding of the man-forest-land relationship.

REFERENCES

- BURESTI E., FRATTEGANI M., 1994 – *Arboricoltura da legno di qualità*. Il dottore in scienze agrarie e forestali, 50, 6, 15-19.
- CIANCIO O., 1991 – *La selvicoltura oggi*. L'Italia Forestale e Montana 46, 1, 7-20.
- CIANCIO O., NOCENTINI S., 1994 – *Il metodo del controllo e la selvicoltura su basi naturali: un problema culturale e di gestione forestale*. L'Italia Forestale e Montana 49, 4, 337-356.
- FLAMMARION J.P., 1993 – *Sylviculture et diversité biologique in: La Biodiversité*. ENGREF, pp. 84.
- GIANNINI R., 1994 – *La biodiversità degli ecosistemi*. Giornate di studio sul «Global Change» Il ruolo della Vegetazione. Accademia dei Georgofili.
- GIAU B., FURLAN G., 1993 – *La carta della qualità economica dei boschi, strumento di pianificazione forestale*. Atti del Seminario UNIF di Pianificazione Forestale. Brasimone (In Stampa).
- GIAU B., FURLAN G., 1994 – *Valutazione della qualità economica dei boschi*. XXXI Convegno «Lo sviluppo del mondo rurale: Problemi e politiche, istituzioni e strumenti». Società Italiana di Economia Agraria (In Stampa).
- LAGAZZI L., 1988 – *I segni sulla terra. Sistemi di confinazione e di misurazione dei boschi nell'alto medioevo*. In: Il bosco nel medioevo, pp. 369. Cleub. Bologna.
- MC HARG, 1969 – *Design with nature*. In: Saini, La pianificazione ecologica del territorio. EDA. 1985.
- HELLRIGL B., 1986 – *I compiti dell'assestamento forestale*. In Nuove metodologie nella elaborazione dei piani di assestamento dei boschi. ISEA pp. 1133.
- MONTACCHINI F., CARAMIELLO R., FORNERIS G., PIERVITTORI R., 1981 – *Carta della vegetazione della valle di Susa ed evidenziazione dell'influsso antropico*. C.N.R. AQ/1/220 pp. 114.
- PIGNATTI S., 1994 – *Ecologia del paesaggio*. UTET pp. 228.
- SAINI R., 1985 – *La pianificazione ecologica del territorio*. EDA. pp. 89.
- VIOLA F., 1994 – *Pianificare la «natura» guardando la città*. Dendronatura 15, 1, 7-14.

Vittorio Leone

THE MEANING
OF SILVICULTURE TODAY

THE MEANING OF SILVICULTURE TODAY

In times previous to the major development of industry and transportation, the worker in the fields went about his task of supplying man and livestock with food, and industry with the necessary raw materials. The farmer's duties were mainly those of cultivating the soil and producing various types of agricultural commodities.

This enunciation of the meaning of agriculture from an Italian classic of economic historiography (SLICHER VON BATH, 1976) is of assistance to us in attempting a definition of silviculture.

The meaning of agriculture has indeed remained unchanged throughout time. The difference between a Mediaeval grower of wheat and a modern grain farmer lies in the agricultural technique, the technical instruments, the yields, progress and technological innovation, and the position regarding the market. But both share an organised activity of exploitation of a resource so as to obtain produce satisfying various needs.

The same cannot be said for the term «silviculture». Although its lexical structure embraces the concept of the cultivation of resources, it is difficult to find univocal and constant meanings.

In fact, to verify what I have stated it is sufficient to examine a few definitions.

«Silviculture» means:

- cultivation of a set of trees with the principal aim of obtaining more and better timber (DI BERENGER, 1863);

- cultivation of the forest, i.e. the complex of cultivation procedures for regenerating or planting, breeding, and felling of forest tree stands (DE PHILIPPIS, 1960);
- the art of producing and tending a forest (SMITH, 1962);
- the application of the knowledge of silvics in the treatment of a forest (SMITH, 1962);
- traditional silviculture and industrial silviculture are two different activities, even though they yield the same product - timber (PATRONE, 1970);
- the art of exploiting forest cultivation (SOCIETY OF AMERICAN FORESTERS, 1974);
- the exploitation of forest vegetation so as to satisfy man's needs (SOCIETY OF AMERICAN FORESTERS, 1974);
- the science studying the phenomena relative to the vegetation of the natural forest and the art of using the latter without altering its functioning (LANIER, 1986);
- the art of applying the knowledge acquired in forestry science (LANIER, 1986);
- the art of applying techniques founded on scientific and biological bases, with the aim of controlling natural forest development and rationally guiding its evolution towards the desired direction, whilst conserving its natural productive forces (LEIBUNDGUT, 1987);
- the science and practice of cultivating forest crops, based on a knowledge of silvics, ... controlling the establishment, composition, constitution and growth of forests (TERMINOLOGY OF FOREST SCIENCE, TECHNOLOGY PRACTICE AND PRODUCTS, 1971);
- management of timber growth (WEBSTER'S DICTIONARY, 1984);
- forest cybernetics applied to society's needs (SCHUTZ, 1990);
- set of cultivation activities carried out in the forest in response to the demands of individuals and the community and having various aims (PIUSSI, 1994).

It is evident that, unlike terms which univocally refer to

forms of cultivation (i.e. the co-ordinated exploitation techniques of a resource, with the purpose of achieving a specific production, such as in the cultivation of olives, vines and citrus fruits), the term «silviculture» has gradually changed its term of reference: the forest has assumed different meanings in relation to the historical and economical context. Thus the term «silviculture» has undergone adaptation and adjustment; the productive aspects seem to have lost their pre-eminent position compared to other characteristics.

Furthermore, compared to agriculture, silviculture is characterised by the long life cycle of forest trees, by the «natural» quality of the productive system, by the use of wild species and the presence of the entourage of organisms associated with them, but, above all, by the fact of ensuring, all together, multiple and various services (SCHUTZ, 1990) which are completely extraneous to agriculture.

It may, accordingly, be useful to review the role of the forest over an ample stretch of time to highlight the diversity of functions and products which it was called on to supply, and thus achieve a better understanding of the evolution of the term «silviculture».

In the thirteenth century, many houses were being built in the expanding cities; along the rivers and on the sea coast a large number of ships, which usually lasted no more than ten years, were being constructed.

The forest supplied a quantity of materials which became increasingly necessary: firewood for household use, for kilns and workshops; resin for torches; bark for ropes; lime, ash, charcoal...

The expansion of vineyards brought a high demand for wood for barrels and vats, i.e. containers which had to be renewed at each grape harvest, and for vine poles which enabled the plants to resist hoarfrost.

It was at that time that men began to consider the forest as

a precious asset which deserved special protection. Thus it was that regulation of forest use commenced, defining the rights and authority of the forestkeeper over peasants and shepherds.

The change was far-reaching when compared to the status of the forest in the early Middle Ages. Then the forest was a resource, accessible to anyone, which everyone could draw from according to his need; a vast pasture where domestic animals, pigs, sheep and huge droves of horses, the source of the nobility's cavalry, roamed freely (DUBY, 1970).

The forest was progressively more protected, because it had to provide for primary needs of house construction, handicrafts, ship building and domestic heating.

In this period, moreover, management still tended towards conservation as the forest represented a stockpile providing the means for labour and a reserve of the productive forces necessary for the community's material life (QUAINI, 1974).

In this development model, the communities still regulated forest exploitation in a way which was not destructive, and to a certain degree safeguarded the environmental resource they depended on.

All the same, the presence of vast areas of forest also called for an almost complacent attitude in man's victory over a hostile, powerful nature, and clear cutting was therefore engaged in without excessive disquiet so as to increase the productive base of agricultural activity. This has, for centuries, constituted a *neutral operation* – until proved otherwise – as VECCHIO acutely observes (1974).

The distinction between the two different approaches is linked to a different organisation of the land, originating from a new antagonism between the city and the countryside and from the supremacy of the market and industrial production. This type of model relates the exploitation of any resource to an increase in capital value and profits.

The crisis started in the eighteenth century and reached a peak in the nineteenth with widespread forest destruction. This was the outcome of the introduction of an economic and social system which encouraged the depletion of resources and which, in the name of privatisation, reduced community control.

At first this economy supported saving of forest resources, but subsequently replaced it with accelerated forms of destruction, linked both to the demand from the expanding cities and especially from the so-called fire industries (iron and glass works, brick kilns and potash plants), preferably sited in fuel-rich areas.

The transfer from a pre-industrial organisation, based on isolation, home consumption and a situation of self-sufficiency, to an organisation where capitalistic use of the land predominated was not just a political event, but it ended up in loosening the mechanisms of defence and regulation of forest use and management.

In this context, the not always positive inter-related effects of the increase in farm land, the plowing of new soil, land reclamation projects and alterations in ecological conditions began to be felt. In the connection between deforestation, erosion, landslides and raging floods, a need for shrewder, stricter management of forested land was discerned.

Forest destruction and its consequences (washout, land slides, ruinous floods) often coincide with a scarcity of wood for domestic and agricultural use, a shortage of grazing land and a reduction in production.

The increased awareness of the forest's role in regulating water downflow inspired the first laws of the young Italian State which set restrictions on forest use based on hydrogeological considerations. But this did not prevent a further massive attack on the forest consequent to industrial develop-

ment and to the construction of the railroads which created an immense demand for railway sleepers.

We can thus identify four successive stages in the history of silviculture (PAPANEK, 1984). In the first stage, silviculture is concerned with timber production, more for strategic military than for civil use. In this regard, it is worth remembering that the political fortunes of many states in the Modern Age were closely linked to the availability of material for the construction and maintenance of a military fleet.

The role played by the forest in maintaining watershed stability was acknowledged later. More recently this has been integrated with the ecological function which guarantees various environmental services.

The satisfaction of cultural demands, such as open air recreation and associated functions, is the last to appear. These exalt the role and the effect of the forest on the human body and mind (therapeutic function), when compared to disorderly and hectic urban life.

This function includes the issues tied to a return to nature: the search for intact habitats, the creation of protected areas, camping and picnic sites, possibilities for horse-riding, sunbathing, the gathering of plants, fruit and mushrooms, birdwatching and the observation of nature or «biowatching».

The satisfaction of personal needs also includes artistic inspiration, deep meditation and the search for solitude in a rarefied environment, the qualities and uniqueness of which are summed up in the perception of the *genius loci*.

Is it not to the forest and its mystical fascination that we refer when we liken the columns of a Gothic cathedral to a petrified forest?

It is clear from what has been said that the modern forester can no longer be concerned only with timber production because society's needs appear much wider and more diversified.

The current task of silviculture has, in fact, changed in favour of multi-functional management, which combines forest functions over the same area as integrated functions (PAPANEEK, 1984). The focus is not just on raw materials, but also on more effective protection and on an environmentally sound use of the forest, by balancing and harmonising functions, maximising benefits but minimising costs.

In the first instance, a solution can be seen in that which some define as *function integrating forestry*.

Moreover, this follows the exploitation of a resource, although trying to reconcile uses which are apparently at odds with each other, if not in direct conflict.

The next step cannot be separated from the cultural dilemma as to whether to favour unconditioned protection or whether to satisfy society's various economic demands.

It has been asserted that man's presence transforms the forest from an element of natural history to an element of social history (PIUSSI, 1994).

It is a relationship, however, which is characterised by the constant prevalence of society's material needs which have directed the forest structure towards models functional to economic ends, modelling (if not forcing) its composition and regeneration: the forest is the passive, subordinate object of merely economic choices.

It is singular to observe how the forest seems to have remained the only subject in the current historical context not yet in possession of autonomous rights, and this despite the plurality of assets gleaned from it which often render its role of timber production marginal.

As in the past, manipulations continue to represent neutral operations until the opposite is proved and even the destruction of the forest persists (by fire, for example), merely stirring up the bland apprehension of sensitive minorities.

Accordingly, besides the fine-tuning of methodological

instruments in order to operate within forest ecosystems, today there is the need to approach the issue in a different way so as to place the forest in its role of a component of the overall equilibrium.

In the COLBERT ordinance in 1669, the first «Charter» which fixed the main lines along which modern forestry policy runs, the role of the forest was officially recognised and defined: it serves «... for the needs of war, as an ornament of peace, and for incrementing trade ...».

Today the parameters are different. The forest, a primary element in both popular fantasy and the collective conscience, as well as a fundamental aspect of the biosphere, ensures multiple and various services.

This plurality of service (in particular, the conservation of biodiversity is irreplaceable) today enlivens and inspires a vigorous current of thought, which postulates the forest entity as being a new subject with autonomous rights.

Is it possible to talk about forest rights and to define management rules coherent with this assumption without remaining in the abstract limbo of discussion and learned conceptual elaboration?

A starting point could be that of precisely defining a model of refined silviculture (SCHUTZ, 1990), which is oriented towards favouring naturalness and which is capable of ensuring a multiplicity of functions, not necessarily linked to the traditional utilitarian outlook. The forest constitutes a source of knowledge, memory, culture and life, as well as concrete assets (CIANCIO and NOCENTINI, 1994), and silviculture must accordingly adjust to all this.

It is not easy, however, to pass from traditional, pragmatic management aimed at biomass production, to management where the forest is a superior asset of public interest.

A forest organisation that follows the lines of geometrical and financial criteria, although improved over the centuries

in the attempt to solve productive problems, is clearly unsuitable for managing biodiversity, which subtends complexity instead of simplification, and a relationship more in harmony with the spirit than with commerce. The same is true for the measurement parameters and elements adopted in management oriented towards production.

What may be the guidelines that inspire new rules for the conservation and enhancement of biodiversity and complexity, and subsequently for a definition of silviculture that responds to current demands?

First of all, a univocal (not just lexically speaking) reference must be reidentified. What do we mean by «forest»? What does not come under that category? Management patterns which are more distinctly productive and which bring silviculture nearer to agricultural practices cannot be set aside where there are simplified structures involved, planned and carried out in the prospect of timber or wood biomass production, which is increasingly in demand.

Such patterns have unmistakable management models, space and time limits and felling methods.

However, not all tree summations constitute a forest and it is, therefore, only in the presence of the latter, the place of biological diversity, that the devising of new rules of conduct and especially of mental attitudes is necessary.

Sustainable intervention in the forest must be based on recent research results, and the impact in terms of stress and reaction of the complex forest reality must be evaluated beforehand.

Besides implementing sustainability, management intervention must, however, respect the metaphysical dimension of the forest as a place of sensations, that inspires sentiments and is the site of the spirit *par excellence*.

The growing and ineluctable demand for biomass and for raw material for various uses should rather stimulate specific

initiatives with the aim of wood production. These should be ample enough to contribute to the solution of production problems, but must be devoid of cultural and affective significance.

REFERENCES

- BERNETTI G., MANOLACU GREGORI M., NOCENTINI S., 1980 – *Terminologia Forestale*. Acc. It. Sc. For., CNR, pp. 518.
- CIANCIO O., 1994 – *I diritti del bosco*. L'Italia Forestale e Montana, 5: 445.
- DE PHILIPPIS A., 1960 – *Appunti dalle lezioni di Ecologia Forestale e Selvicoltura generale*. Vol. 1, CaM, Firenze, pp. 226.
- DI BERENGER A., 1863 – *Studii di archeologia forestale*. Rist. foto-lito Acc. It. Sc. For., Firenze pp. 806+83.
- DUBY G., 1976 – *L'economia rurale nell'Europa medievale*. Universale Laterza, Bari, voll. 137 e 138, pp. 257+623.
- LANIER L., 1986 – *Précis de Sylviculture*. ENGREF, Nancy, pp. 468.
- LEIBUNDGUT H., 1987 – *Vom Holzfackerbau zum naturnahen Waldbau*. Oesterr. Forstztg 1,4: 10-11.
- PAPANEK F., 1984 – *Teoria della gestione polifunzionale della foresta con riferimento specifico all'economia forestale*. Pubblicaz. Corso Cultura in Ecologia, Atti del XXII Corso, sett. 1985. Ist. Selvic. Univ. Padova: 1-156.
- PATRONE G., 1970 – *Economia Forestale*. Tip. Coppini, Firenze, pp. 676.
- PIUSSI P., 1994 – *Selvicoltura Generale*. UTET, Torino, pp. 415.
- QUAINI M., 1974 – *Storia del paesaggio e dell'organizzazione territoriale?* Città e Regione, Anno 2, 1: 20-36.
- SCHÜTZ J.P., 1990 – *Sylviculture 1. Principes d'éducation des forêts..* Presses Polytechn. et Univers. Romandes, Lausanne, pp. 243.
- SLICHER VON BATH B.H., 1976 – *Storia agraria dell'Europa occidentale*. Piccola Biblioteca Einaudi, PBE 173, Torino pp. 542.
- SMITH D.M., 1962 – *The practice of silviculture*. John Wiley & Sons, New York, 7^a ed., pp. 578.
- SOCIETY OF AMERICAN FORESTERS – *Forestry Handbook*. Foresters, 1974.
- VECCHIO B., 1974 – *Il bosco negli scrittori italiani del settecento e dell'età napoleonica*. Piccola Biblioteca Einaudi, PBE 235, Torino, pp. 276.
- WEBSTER, 1994 – *Webster's New Encyclopedic Dictionary*. Köhnehmnn Verlags GmBh, Cologne.

Roberto Scotti

FOREST MANAGEMENT
AMID DETERMINISM AND INDETERMINATION

FOREST MANAGEMENT AMID DETERMINISM AND INDETERMINATION

Introduction

«The forest and man», a round table conference, an opportunity for discussion. I propose, quite simply, to contribute to the debate by highlighting one aspect of the theme and expressing my point of view.

«The forest and man», what is there to talk about? Where does «Forest management amid determinism and indeterminism» come in?

Forests, as fundamental components of the ecosystem which our existence depends on, in the context of the tremendous impacts of man on the functioning and equilibria of earth's ecosystem, contribute to the planetary level of a problem we are urged to face.

The particular importance of forest for the environment in Italy, the substantial drift in governing interactions between man and the forest and the continual loss of influence that the science of forestry is suffering in environment administration, together devise a specific national level to the problem.

Finally, the (not haphazard) order of terms in the binomial expressing the theme of the meeting provokingly indicates the trend which the conference proposes to place under discussion and towards which the quest for solutions be directed.

First the forest and then man. Silviculture is all for the forest, in favour of the forest. The forest as a subject of rights. If my interpretation is correct, I detect important constructive aspects in such a challenge.

One aspect is, for example, that I feel this is a correct way to face environmental problems: mankind depends on its natural environment.

Another aspect I agree with is the need to promote a considerable cultural impact to succeed in reasserting and advancing the role of the science of forestry. It is not on these aspects, however, that I intend to dwell, but rather on some developments of the proposal which do not seem constructive to me. Developments which, in the sphere of forestry management, come to a standstill over sterile, unproductive items of controversy.

Forest management basic paradigms

In putting forest management in perspective, reference should be made to the triple concept of man-environment-society, rather than to the binomial forest-man.

Silviculture is, in fact, an activity which takes shape through interaction with a significant component of the environment and it necessarily comes up against two ranks of problems.

There are problems which can be defined as internal. They develop when the reactions of the system-environment betray the expectations of the intervention carried out (logging operations provoking successive yield reductions or conservative management practices determine instability or regression of the ecosystem).

There are problems definable as external, concerning implications of silviculturists' actions for society on the whole (alterations of ecological equilibria, the loss of natural equilibria supported by cultivation, etc.) or, vice versa, which society ascribes to silvicultural activity (including the ancient problem of grazing in the forest, hunting or intensive recreational activity).

In planning silvicultural activity, forest management is confronted with these problems on a theoretical level and must propose actual solutions also on a practical level.

In very general terms, the two ranks of problems are dealt with in forest management theory on the basis of the assumption that the perpetuity of the forest constitutes a common minimum fundamental need and therefore the keystone (first basic paradigm) for the development of the theory. With regard to planning, this theory is presented as a problem of constrained optimisation (second basic paradigm): the search for maximum constant yield, maximum economic return, maximum benefit, etc.

Determinism

A yield table or the corresponding «norm» for uneven-aged forests sums up the essence of forest management in one image.

The discipline was founded and developed with the idea that, once the causes are known, it is possible to forecast the effects and, consequently, under ideal conditions, a forest managed according to indications defined by the silvicultural «standard» is very likely to develop according to the assumed optimum growth pattern.

The evolution of socio-economic conditions and technological development have, today, made the problem of optimisation of the forest planning strategy much more articulate and complex.

The model, or representation reduced to the essential of the principal elements considered in planning has evolved. With current modelling methodologies, the reference to the «normal forest» concept turns out to be marginal but, the postulate of the possibility of forecasting the effects given

the causes is, if possible, more convincing. Given present conditions of the forest, the model makes it possible to estimate how variations in guiding factors will influence its evolution.

Rejection of the validity of the deterministic approach

The developmental trend that the theme of the round table conference may put forward, with the prospect of integrated ecosystem management, leads to emphasising the complex character of the forest inasmuch as it is an ecosystem. Such emphasis takes form in the idea that the reactions of a complex organism cannot be entirely understood by breaking them up into separately-analysed elements on the basis of simple, basically deterministic models.

I am in agreement insofar as I consider this challenging hypothesis interesting and stimulating. However, until we manage to prove its concrete nature by demonstrating how alternative methods get better results, it is necessary for this idea to maintain its value of a challenging hypothesis.

I do not agree, however, with adopting it as a postulate on the basis of which the validity of the deterministic approach is rejected.

In actual fact one must admit that the comparison between observations and estimates produced by the models is often discouraging. Furthermore, models may be extremely refined – indeed, in some aspects the more refined they are, the more frequently their application may confute them. This is especially true when we consider that, as already mentioned, the complexity of the management reference frame has rapidly grown, further reducing models' estimation potentialities.

I do not agree in assuming these difficulties as justifica-

tion for criticisms of the deterministic approach that seem to go as far as basically considering that predicting the reactions of a complex organism like the forest cannot be proposed.

In fact, planning in these conditions can only develop on the basis of largely subjective choices, entrusting future monitoring with possibilities of controlling, corroborating and correcting the choices made. The definition of a strategic development outlook with a minimum of detail clearly appears out of place.

The determinism which, even in a limiting way, has up until now characterised forest management is being replaced by a condition of practical indeterminateness where even short-term forecasting has low reliability.

So, is there still any point in talking about forest planning or management?

I should like to close by recalling an actual situation where, in my opinion, the unproductiveness of head-on confrontation between supporters and opponents of the deterministic approach is particularly obvious.

Wind and snow breakage in fir stands and effects of thinning

Some easily acceptable ideas could be:

- 1) that a broken tree stem has been truncated upon being subjected to a strain exceeding its resistance threshold;
- 2) that, according to the mechanical model we refer to, it is possible to quantify such a threshold.

Likewise, it is evident what importance having the means of forecasting could play in planning (and perhaps in modifying) the risk of breakage in fir stands.

On the contrary, however, the bitter controversy provoked by some of the works put forward on this subject has not

contributed anything, leaving seemingly irreconcilable positions unaltered.

On the one side there are those like us who, generalising the mechanical model which is easily acceptable for the single tree, and extending it to entire populations, exaggerate by simplifying it in their attempt to express the «breakage risk threshold» in terms which can be used operatively in planning. On the other hand, there are those who, in the inexorable necessity to sustain the complex character of the forest inasmuch as it is an ecosystem, highlight the contradictoriness of situations observed and seem to come to a halt at the assertion that simplifying the phenomenon is misleading.

I personally believe that, if one accepts that the progression of knowledge exists and there is agreement in wanting to pursue it, the avoidance of simplification is not possible. Without simplifying, it is not possible to escape from the indetermination inherent in the large variety of particular cases.

Once the limits and shortcomings of deterministic simplifications have been emphasised, it is then indispensable to recognise its analytical potential and use it.

Mariagrazia Agrimi

FORESTRY EDUCATION
AND THE CULTURAL TRAINING
OF THE FORESTRY GRADUATE

FORESTRY EDUCATION AND THE CULTURAL TRAINING OF THE FORESTRY GRADUATE

Forestry training is slowly responding to the forces of social change. The disciplines of silviculture and forest management which are traditionally imparted in university courses are, in the name of ecology, being contested from many directions. This is the opinion expressed by FREDERICK F. GILBERT (1994) of the University of Northern British Columbia (Canada). He observes that discussions about the integrated management of forest resources abound but merely lead to a superficial re-touching of academic programmes while remaining true to traditional teaching procedures and resisting the necessity of adopting a new philosophy in forestry training.

But what is meant by a «new philosophy in forestry training»? What principles is it based on? What need is there for change and in which direction must the training of foresters be oriented?

The answers to these questions can be drawn from the analysis of a few facts which are clear to everyone and which show how the necessity to instigate a debate in both the professional and training worlds is felt on an international basis.

Society has by now acquired an awareness of the role of public concern fulfilled by the forest, as highlighted by CIANCIO (1988). However, GIAU (1992) points out that the heightened consideration given to functions which cannot be monetised has had an unwanted effect: that of relegating foresters to a role of secondary importance in management.

According to LAURENCE ROCHE (1990) of the University of Wales, Bangor (UK), the contemporary world does not expect anything in particular from foresters, basically because they are still seen as «woodcutters». This is the image that is spread by the mass media and which city people are aware of. There are a few cases where interest in botany, zoology or chemistry saves the soul of the forester, so to speak, but this is not enough to cancel the «original sin» of having being *trained* as a «woodcutter».

BRUCE P. DANK (1990) from the University of Alberta emphasises that foresters risk having the responsibility for managing natural resources taken away from them... first of all because they have lost credibility in the eyes of the public, increasingly more informed about forest problems, and secondly because they have rarely shown their attitude for managing the forest for purposes other than timber production.

From the various opinions, there emerges the necessity, in the sphere of forestry activity, to identify not only ecologically and economically sustainable solutions but also ones which are socially recognisable and acceptable. But, in order to do that, the cultural formation of the forester offering himself on the job market must be reviewed and the current academic programmes and teaching methods must be critically examined.

Future forestry training not only needs to look towards ecosystems, even on a planetary level, but also to adopt an outlook which is integrated between biophysical and social sciences. In short, the aim of the programmes should be to train professional people who are capable of thinking and solving problems and not mere biotechnocrats.

In order to achieve these aims, the main tracks to be followed by a training course should respond to the principles listed below:

- 1) Overcoming the prevalently technical aspect of traditional

courses, with the aim of developing the students' critical skills regarding conventional proposals, but without – obviously – imposing new schemes.

These newly-conceived courses, experimental by definition, should be kept well away from approaches of the «venerable texts» or «great ideas» type so that topics can be presented interdependently as interesting sources of information.

The forestry student will not face the various concepts of the course by himself, but he will, instead, be encouraged to discuss the various themes presented with his professor and with his peers.

- 2) Presentation of the management of forest resources in a more balanced perspective, i.e. not exclusively tied to timber production.

Teaching programmes should recognise that forest management concerns a system and should consider social, cultural, biophysical and economic factors all together, as they may weigh on management decisions. Students should be urged to consider the consequences and implications of their choices.

- 3) Constant effort to ensure that instruction is truly interdisciplinary and the result of co-ordination between faculties.
- 4) Emphasis on the responsibility that those who manage resources have towards society, as well as towards their own profession and their particular employer.

Indeed, a society attributing increasingly greater importance to the life of diversified and healthy forests, which represent qualifying elements in the landscape, will make increasingly greater demands on professional cadres. They will expect from them land management which complies above all with the ethical principles tending to consider the forest as a value in itself and not just as an asset.

- 5) Development of the attitude of working towards the

defence and conservation of ecosystems in collaboration with other professional figures.

- 6) Conveyance of the capacity to participate in socio-political and cultural life.

In order for each to be up to his own task, graduates in forestry must be well aware of the value systems expressed by the society where they will be engaged.

- 7) The creation in the students of a spirit open to learning, educating them to continual training throughout their professional lives.

An example is given by technological updating which, at the present moment, represents a decisive element in the employment of graduates on the job market. The student must acquire the awareness that technology always constitutes a means and never an end and he must be given a footing which will allow him to evaluate the benefits and consequences that derive from its use.

- 8) The introduction of a greater flexibility in teaching with the use of training modules, which include topics of theoretical, ethical, historical and social nature. The aim is to form a mentality which is capable of reasoning in a complex way and of analysing problems for successive hierarchies (according to a widely-known aphorism: *think globally but act locally*).

With regard to this last point GILBERT, together with other scholars, supports the abolition of disciplinary frontiers in universities (they only tend to divide knowledge into compartments), so that students may start off with intellectual instruments from a variety of disciplines, thus placing them in a position to perform their social duties. These teaching programmes could give rise to an integrated course in «Methods of social sciences applied to forestry issues», including demography, anthropology, sociology, political sciences, psychology, history and economics.

At the University of Northern British Columbia, for example, the forestry teaching programmes in the «Natural resources» course deal with *Integrated resource management, History of resource management, Planning, Watershed management, Study of environmental impact, Ethics* and connected issues. These courses, integrated with a period of practical training, represent a chance for students and the teaching staff to examine the different ways of contemplating resources, according to the concepts presented by the different disciplines, and to look for interdisciplinary solutions to problems. The introductory courses in chemistry, physics and biology are reduced to one semester if the student has taken these subjects before enrolling at university (GILBERT, 1994).

In North America, interest in the renewal of training techniques is considerably felt even by such institutions as the Society of American Foresters, the Institut Canadien de Foresterie and the association of forest engineers in British Columbia. Debates within national professional organisations will influence the way in which teachers modify the foresters' curricula (or could do so) because these institutions have the task of qualifying forestry graduates for professional practice.

It is therefore clear that the social scope of forestry education is strengthened.

The opening of a debate on the themes mentioned above proves to be of vital importance because considerations, proposals, indications of experiences under way and so on may emerge (even from the Italian forestry world) and urge those institutions delegated with training responsibilities not only to give fresh vigour to their teaching programmes, but also (in collaboration with research institutes, public organisms, industrial groups, businesses, private and public forest property owners and professional associations) to promote activ-

ities for updating those already employed, so that forestry graduates may be credited with a new social and professional role.

REFERENCES

- CIANCIO O., 1988 – *Il bosco bene di interesse pubblico*. L'Italia Forestale e Montana, 43 (4): 268-270.
- DANCIK B.P., 1990 – *Lost opportunities and the Future of Forestry: Will We Respond to the Challenges?* The Forestry Chronicle, 66 (5): 454-456.
- GIAU B., 1992 – *Nuovi orientamenti della formazione universitaria in Italia*. In: Atti Conv. «Formazione forestale universitaria e post-universitaria». Ormea (CN), Italia.
- GILBERT F.F., 1994 – *Responses de l'enseignement forestier à l'évolution des valeurs sociales et des savoirs sur les ressources*. Annexe 5: 55-69. Enseignement forestier. Tendances récentes et perspectives. Etude FAO Forêts 123.
- ROCHE L., 1990 – *The profession of forestry: a modern synthesis*. International Conference on Forestry Education. Proc. Vol. 1. Univ. of Tuscia, 17-22 September 1990, Viterbo - Italy; pp. 151-170.

Paolo Zoni

REFLECTIONS OF A STUDENT

REFLECTIONS OF A STUDENT

Everyone today, be they good or bad, is concerned about forests today, or at least trees. Let us remember that 1995 is European Nature Conservation Year. Just consider how much various plants are used as symbols (especially on the political scene): the oak, the olive tree, ivy, the four-leafed clover and so on. Could it be that, rather than concern, exploitation is the case?

Let us clarify the issue straight away; if we are talking about the Forest-Man relationship, then we cannot discuss events which suddenly find that one of the points in question is missing. The notion that the forest is an entity with rights, which means it can be considered as a subject, comes across ever more strongly and some even go so far as to say that the forest has a Soul. We need to think for a moment and try to understand. We could probably assert, without offending anyone, that the forest's true soul springs from the conscience of whoever contemplates it and the respect that he bears it.

We do not wish to drag in the saints, but it would be sufficient to read up Prof. PATRONE's *Stravaganza V and Somma* to appreciate with what sensibility and sense one should discuss the forest. These words have remained empty for too long. Today we must change direction and the young (foresters or otherwise) should bring their weight to bear in this matter.

As a forestry student, allow me an observation, and here I am addressing the academic world. If the Forest-Man relationship is really so important, why is it that still today, in the new layout for the Degree Course in Forest Science (to be re-

named Forest and Environmental Sciences), apart from classical disciplines such as Botany, Silviculture, Forest Management and Economics, we do not find History, Anthropology or Sociology? I consider this further step forward fundamental if we wish to keep abreast of the present situation and not feel crushed by other professional figures with whom we should not fear conflict but rather seek collaboration.

We must give society some answers. The discussions often seem to stop at mere factual knowledge and it is as if we would be satisfied with formulas from the past to answer present day questions. We do not want to deny the past, on the contrary.

The impression is that roles were clearer in the past, both for good and evil. Man who suffered and died of starvation knew that the Forest could, at least partially, fulfill these primary needs. Today, however, for good and evil, the factors have changed. We no longer die of hunger (at least not in the Old World), but we die of the effects of development and more and more people are being stricken by nervous disorders, while the problem of the Forest seems to remain the same as ever: to cut or not to cut.

Well, then, we must rouse ourselves from that facile simplification.

Universities and Academies are not simply for training technicians, but for forging people. People who are capable of assessing and conducting a dialogue, who are not all the same (this is not what we want) but who share a common trait – interest in and attachment to reality. This is how misunderstandings between the different components (farmers, citizens, hunters, environmentalists, etc.) could be simplified and faced constructively.

I am convinced that we foresters (I refer to us young foresters in particular) have more to our credit than we think, but we must know how to put forward our arguments, with-

out haughtily and arrogantly isolating ourselves in our certainties. Thus, those among us who will have the honour of instituting new protected areas or managing those already in existence will not be considered just the latest dictator, but rather as an important collaborator of the populations involved. Accordingly, those who will promote a permitted kill ratio will not be labelled as mass butchers. Allow me this consideration, rather banal perhaps, but true: everyone's collaboration is needed, whether they be politicians, academics, officials or even us students, so that the Forest-Man relationship does not remain a topic of conversation for the drawing room «while everything carries on as before».

Finally, I cannot avoid touching on the problem of employment. I can assure you that, whoever enrolls in our Degree Course does not do so out of economic ambition, but rather because the choice brings with it a great emotional charge, together with a sincere desire to do something constructive.

I am aware that I have merely alluded to the theme, but these are only a few reflections (and therefore conclusions) which have emerged from lively but congenial conversations held among a group of forestry students. They were not based on experimental data but on some of our university experiences. Accordingly, I hope that this debate will be of avail to everybody and will herald the advent of better times for humanity, times when words become facts, thus bringing employment opportunities to our sector and better conditions to the forest, so that it does not become a mere memory to hand on to future generations.

Paola Porcinai

THE FORESTER'S PROFESSION

THE FORESTER'S PROFESSION

*«The hostility towards beauty as a consequence of worshipping
the useful is the characteristic of our era where we produce
to destroy and destroy to produce again,
refusing the pleasure of contemplation
which does not destroy because it produces, but creates»*

R. Assunto

1 – Introduction

Having been involved for several years in the implementation of forest projects in an international context and being used to thinking things over and discussing themes and problems regarding different countries all over the world, I have often wondered if and how the great scourges which currently afflict humanity such as war, poverty, famine, disease, pollution and desertification, etc. can be resolved. For example, if I think of the problem of malnutrition, I find the answer at the technical and scientific level.

The Earth's resources are not limited and could feed all the planet's inhabitants. Indeed, it has been calculated that it could support fifty billion human beings because there is no lack of land to cultivate, but it should be distributed in a more equal manner. The phenomenon of hunger in the world could thus be avoided with radical changes made on economic, social, ethical and other levels. Even other problems such as deforestation could be overcome if we looked beyond science for a solution.

On a rational plane, we are capable of finding the answer to the «civil» world's problems, but when we look further, the solutions that are proposed seem to be Utopias.

Though it would appear a vain hope that the world should manage to adopt valid ethical precepts for everyone, each person could at least behave in a responsible way in defending general interests, which must triumph over personal interests which are dictated by egotism.

Fundamental human rights do not exist; it is Man who creates them and who must guarantee they are respected. In my opinion, it is for this reason that we should, each one of us in our own sector, always endeavour to reach new objectives and transform them into conquests for all, into universal human rights.

2 – The forester's profession at the threshold of the year 2000

In 1993, the «Forest Stewardship Council» was instituted on an international basis, its main principle being to promote a system of management which could be «supported» by the forest on a world-wide scale, bearing in mind the various functions of the forest ecosystem (ecological, economic, social, landscaping, etc.).

Without being able here to go into the problems linked with forest ecocertification and the ensuing economic and commercial implications, the event provoked violent reactions from European foresters. «Our management methods, widely practised in Europe and based on in-depth study, are recognised as models throughout the whole world!» the protest went up. Refusing the work of experts and wanting to entrust the task of certification to other professionals is also ignominious.

This fact reveals two aspects of the situation clearly:

- firstly, that it is indispensable for the divulgation of the forest to emerge from the «coterie» of specialists and to reach those who have at heart the conservation of ecosystems and

- of the genetic heritage, the protection of fauna and the safeguarding of the landscape, etc.;
- secondly, that, perhaps in the future, it will not only be foresters who deal with the forest. In fact, there is an increasing number of people who, in trying to interpret society's various demands, have the means (and are also beginning to acquire the competence) to call the forester's work into question, or to replace him when he does not come up with valid solutions for the forest or the environment or is unable to communicate with those who do not belong to the «world» of the forest.

The land and the forest itself were, in the past, managed for productive purposes, even intensely so. In industrialised countries today, society also expects other values, such as the improvement of environmental qualities (unpolluted water and air, etc.) and the quality of life from the landscaping, cultural and spiritual perspectives.

The importance of the forest in fulfilling these roles is undeniable and this cannot be achieved only in a few areas (parks, reserves, etc.) scattered over the land, but everywhere, because the social demand for green areas is always on the increase, along with the demand for unpolluted water and air and for beautiful, seemingly untouched scenery.

The first symptoms of imbalance in forest ecosystems (decline) have set us off thinking and asking ourselves questions about the future of the forest and about the kind of silviculture that will have to make more and more allowances in negotiating the increasing hazards and for the progressive restriction of operative margins, and will have to look for a way to satisfy society's multiple and often divergent demands.

Guaranteeing the perpetuity and good health of woodland ecosystems is, therefore, the first requisite which must be satisfied. This involves the forester, who must assume his

responsibilities for being in a position to stabilise and ascertain the biological potential of the forest. This is not all. The forester will always have to cope with reconstituting degraded forests and, in collaboration with other specialists, with salvaging damaged land.

There is, very often, too much concentration on detail. We have a partial comprehension of the problems, so the solutions put forward are not effective. Then, of course, we do not appreciate the negative consequences that such remedies may bring to bear. Risks due to wrong choices are, in fact, underestimated; there are many eloquent examples of this.

Hence, forestry training must indeed be based on the acquisition of scientific knowledge in various sectors, but also on the development of creative skills. The former is useful because it helps us to appreciate as much as possible everything to do with the forest and its role for society. It will aid us in learning to integrate our research with problems concerning «sustainable» development, the changing environment and the various cultures with their own singular values. It will allow us to turn to research even though well-aware that our knowledge about complex systems, whether at the ecological or social levels, is limited and insufficient.

Mental elasticity must be acquired to enable us to find answers to the new queries with regard to the forest. This will facilitate the comprehension of the forest's material dimensions (but also of its cultural and spiritual ones), the analysis of situations influencing operations in the forest and the knowledge of the economic aspects of the management of forests as private property which at the same time belongs to the community.

In my opinion, the forestry profession therefore requires:

- a) A more thorough knowledge of the forest ecosystem and better comprehension of man and society*

The natural forest is a functional ecosystem, i.e. it is capable of fulfilling useful functions for itself (and therefore also for man) without actual anthropic action. Man, however, modifies it, creating imbalance.

At present, the lack of technical and scientific knowledge in many sectors puts a limit on his capabilities and the quality of his actions. In studying forest ecosystems, we should not neglect the study of the «anthropic» system, given the direct or indirect influence man exerts on the forest. It would be necessary to carry out further research so as to understand the interrelations between the disciplines of interest to man and the environment, such as the integration of economics with ecology.

When operating in an industrialised country, our aim should be the conservation and improvement of the forest, or else its reconstitution, so as to fight against the decline of our land. In this way we could improve environmental quality and culturally and spiritually elevate man, because the destruction of woodland and nature often depends on the absence of culture. In developing countries, operations in the forest should aim to satisfy «essential needs».

Then, the forester, in collaborating with other specialists, should be able to contribute to the realistic resolution of environmental problems and not just in theory. Indeed, numerous solutions can be found by using trees and plants. For example, just think of the filtering action on pollutant materials: the purification of air particles by many arboreal species and shrubs, or the «depolluting» effects on water on the part of trees which, together with herbaceous plants and photosynthetic micro-organisms, are successfully used in some industrialised countries to purify the waste water of cities, farms and industries.

b) Co-operation with others

Because we act on the landscape and for the society, we deal with problems concerning the ecological and humanistic sciences. Collaborating with other professionals is, therefore, important and useful even in removing one's own prejudices (often the outcome of superficial, sectarian and, at times, faulty teaching and judgements) and acquiring greater elasticity of thought. Indeed, each of us has different mental skills because there are various ways of perceiving events and consequently of processing them (our schooling, unfortunately, encourages and often rewards only those individuals with a certain kind of mental faculty, with the result that others, in possession of different skills, are penalised and discouraged because they are not understood).

Many current problems concern the whole world, not single nations. So everybody's collaboration and commitment should be of use even in contributing to boosting solidarity and overcoming conflict between countries.

c) Divuligation of our own knowledge

We are, as foresters, aware of the important functions fulfilled by forests and by trees, but often we are not capable of permitting others to appreciate what we know and consequently we cannot transmit that knowledge which ought to become «awareness». Much faulty intervention is not only due to too many regulations, but also to community activity where forest values are not very clear and therefore erroneous action is taken.

It is a commonplace to call to mind again that forests and trees carry out important functions for man, animals and the environment. For rich peoples, they produce industrial wood, minor products, medicines and a great variety of raw materials for industry. They protect the soil from erosion and reconstitute soil fertility in abandoned areas and water reserves in arid zones. They offer refuge to wildlife. They conserve the

genetic heritage of trees, shrubs and ornamental flowers; and they provide the vegetal material necessary for the work of cross-breeding, genetic improvement and so on.

For poorer peoples, they are an important food source (at times the only one) for men and their animals. They supply firewood, medicines, shade and water. They defend crops from wind and sand, etc.

They produce clean air and water for everybody. They contribute to reducing carbon dioxide in the atmosphere and, in so doing, help protect the earth from overheating.

They provide aesthetic «enjoyment» and recreation and are a source of inspiration for the arts (architecture, sculpture, painting, poetry, prose, music, cinema and photography). For many thousands of years, a dialogue has been kept up between the forest and man. In his contact with trees and the forest, man has found an inexhaustible source of aesthetic inspiration, mystery and deep compassion.

Conveying this and a great deal of further knowledge about trees and forests allows us to hope that one day other professionals (such as engineers, architects, etc.) will save the forest as much as they possibly can and that people, being aware of its multiple utility, will respect it more and will wish to protect it instead of burning it.

d) Sensitivity towards aesthetics

According to a survey conducted in France, the main value that the forest is attributed with is that of natural reserve. What the public does not want is to see a forest area spoiled by infrastructures or which appears artificial because it bears the «brand mark» of man, i.e. it has the characteristics of an unnatural environment.

This means that there is a new attention to landscape and to the form, aspect and dimensions of wooded areas, roads and tracks and of allotments subject to felling, etc.

Among the principles of forest ethics, besides the duty of preventing possible wood «famine» by developing the resources and intensifying production and utilisation, there should also be the principle of acquiring a new feeling for aesthetics, i.e. for nature and the land.

We must, of course, not forget that one of the main economic resources for Italy is tourism, not only linked to her artistic heritage, but also to her areas of natural beauty. Indeed, a landscape which does not appear man-made is among the main requisites that the tourist industry demands.

We look at the forest from an exploitation point of view; we consider it a means, not an end itself, but in the function of man, a simple living being which is biologically conditioned, not an unconditioned thinker (R. ASSUNTO, 1976).

A correct choice tends to preserve the integrity, stability and beauty of a biotic community. It is wrong when it tends otherwise.

Our ability to perceive natural qualities originates in beauty (as does art). True art is, in fact, the freedom of thought which is incarnated in nature, identifying itself in its forms. (R. ASSUNTO, 1976).

The best choice on the grounds of functionality often turns out to be the best choice from the aesthetic point of view. Clear felling, afforestation with single species and other types of industrial exploitation of the forest have proved to be errors. According to studies on the physical and psychological effects of silvicultural techniques on the public, the outcome of such activity is also considered aesthetically jarring.

In order that all functions carried out by the forest may be exploited to the full, it is necessary for them not to be in conflict one with another. First of all, this means understanding and analysing the landscape to make the most of any unique, appealing stretches and to hide the ugly parts. It entails a spe-

cies being chosen not just on the grounds of its productive function, but also on the basis of its capacity to protect the fauna and to enhance the aesthetic and recreational prospects of some areas.

Furthermore, actions in favour of the forest must be planned.

Afforestation with species chosen on the basis of their integration into the forest land could serve the purpose of correcting past errors and could enhance the more attractive areas worth being seen, hiding scenery of too artificial an appearance, such as, for example, industrial afforestation.

In the case of new tree and forest plantations, the search for the right balance between forested and open areas will be necessary, as will the integration of agricultural and woodland areas and the choosing of tree species on the grounds of aesthetic and landscaping criteria, not just productive ones.

We must act so that all forests, not just those included in parks and reserves, recover the most natural aspect possible, because modern man has need not only of wood and because «the disorder in our landscapes reflects the quality of our society which bears no respect for Nature and, subsequently, neither for man» (PIETRO PORCINAI, 1976).

Of course, it is not enough to correctly define the problems and put forward solutions, but we also need to help those living on the land or those who will be involved in the project to understand these solutions. It is important to put our ideas to public proof during the course of research and the processing of the results because the project or realisation will only meet with success if it is understood and «accepted» by man.

e) Proposal of theories or «creative» operations

Imagination and intuition, or the capacity to see beyond the limits of what something is in order to discern what something could be, are the keys to success.

In our sector, the processing and summarising of the elements of our knowledge, extracted from nature or other sources and put together, could give rise to new theories, useful in solving current problems with regard to forests and, therefore, society.

In our century, man felt he was the master of Nature and blindly believed in science and in his ability to change the world. Then he realised that he did not possess these demiurgic capacities and that our society has generally misused both scientific discovery and technological invention. Today we are conscious again of our capacity to solve practical human problems but we have to assume the responsibility of maintaining and enhancing the integrity and productivity of forest ecosystems and of contributing in industrialised countries, to the psychological and spiritual growth of human life. The forester like the artist must try to internalise his own work by studying the forest and trees more and by observing that part which is inside each one of us, in man's memory, because no-one can do without it.

It is imperative to understand where errors have been made in the past and what the real needs of society are.

It is better to do nothing and consequently not interfere with the forest, rather than carry out something badly. Half of the work which is useful to the world consists in fighting damaging and destructive work.

3 – Conclusion

In the past, land and forests were used for productive purposes, and intensely, too. Today they are used for the protection of ecological equilibria and to improve the quality of life in our society, including the cultural and spiritual aspects, as well.

In the future, the professions will be increasingly con-

cerned with the environment: prevention, hazard assessment, pollution control, nature protection, management of land and natural resources and much more.

The deep crisis that the «developed» world is passing through is fundamentally an «ecological» crisis of detachment from nature, from the land.

We must get close to the forest again, learning all over again how to respect it and give it back what has been taken away from it, restoring the equilibria which have been altered and creating new resources. The quality of our work will be improved, along with our actions for the benefit of the forest, the land, the environment and society. We are living through a period of change which is rather trying for those operating according to a professional model which is under criticism from most of our society. The challenge at the threshold of the third millennium is stimulating and will perhaps induce us to find valid answers even if we will be obliged to invent technical solutions and will have to find a compromise between Utopia and the new equilibria which are to be discerned.

REFERENCES

- ALESSANDRINI A., 1990 – *Il tempo degli alberi*. Ed. Abete.
 ASSUNTO A., 1976 – *Una ipotesi di Fondazione estetica*.
 BURLE MARX R., 1987 – *Arte e Paisagem*. Sao Paulo.
 FAO FORESTRY PAPER 120, 1994 – *Decline and dieback of trees and forests*. A global overview.
 GIACOMINI V., 1980 – *Perché l'ecologia*. Ed. La Scuola.
 GIACOMINI V., ROMANI V., 1984 – *Uomini e parchi*. Franco Angeli.
 JELLCOE S. and J., 1975 – *The Landscape of man*.
 PLAISANGE G., 1985 – *Forêt et santé*. Ed. Dangles.
 PORCINAI PIETRO, 1976 – *Proposta per l'istituzione di una Scuola Internazionale del giardino e del paesaggio*.
 PORCINAI PAOLA, 1994 – *Ecoselvicultura*. L'Italia Forestale e Montana. Anno XLIX. Fasc. n. 6. Pag. 634-637.

THE FORESTER'S PROFESSION

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NOTES ON ETHICS IN SILVICULTURE

The authors have contributed equally to this paper.

NOTES ON ETHICS IN SILVICULTURE

Introduction

It can be distinctly felt today that silviculture is going through a critical period. We often wonder if this activity is still of use, if there is still some point to it, if it plays a role in our society or whether it is not becoming anachronistic with each passing day.

This is an issue which is anything but rhetorical, seeing that silviculture is no longer practised in many forests in Italy. This follows the increasingly frequent occurrence of two events which lead to the same result even though the reasons behind them are diametrically opposed: timber utilisation does not provide the owner with income and the forest is abandoned; or else it is environmental obligations, established by law or indirectly imposed by the public, which check any form of intervention involving tree felling, and the forest becomes as though it were crystallised.

With this state of affairs, the analysis of technical factors is not enough to help us understand the extent of the crisis and gauge any hypotheses that could lead to a solution. The roots of the problem go much deeper, entrenched in the heart of the dominant culture.

We must give careful consideration to the issues at stake. To what degree must silviculture be conditioned by financial efficiency? Is silviculture really against the forest? The answers to such questions are perhaps foregone conclusions for foresters; but they are not so in a society such as ours where profit becomes more and more the driving force

behind everything and instances favouring the rights of the single components, including the environment, are often carried through with ideological extremism.

What silviculture is

If the meaning of silviculture seems convulsed or is even rejected, then, before proposing it again (if appropriate) with due firmness, we must first of all reflect on it in order to retrieve it in its authenticity.

What is silviculture? Defining it simply as a set of techniques for cultivating the forest would bring the discussion to an end. Techniques are instruments that man adopts as long as they serve his purpose and do not cause unacceptable damage. But, in the terms set out above, the problem is not a technical one.

Defining silviculture as an applied science corresponds better to the nature of the issue: i.e. it is a body of knowledge, logically interlinked and experimentally checked, which forms the basis of a human activity. Obviously, this includes technical aspects but that is not the end of it. Besides scientific knowledge, every human activity needs an ethical dimension with universal values to refer to. These cannot only be financial or ideological because, in that case, they would change in time and space.

What are the reference values of silviculture which give it a cultural density and a position of importance in human civilisation?

The following definition, afforded by CIANCIO (1981), has offered us the impetus for a more thorough investigation of the topic. He states that the object of silviculture lies in the relationships between natural phenomena peculiar to the forest ecosystem and cultivation techniques, i.e. the ways in which man actually intervenes in the forest. This definition

highlights the fact that, through silviculture, a direct relationship is established between man and the forest.

Because we live in an age which is still dominated by strong subjectivism, any relational nature is strongly impregnated with duality in the terms of the relation, contraposition between them, compulsory choice, or the domination of one over the other. So, the relationship between man and nature, between man and the forest, ends up with having to be either entirely anthropocentric or entirely biocentric. *Tertium non datur* – at least so it would appear.

The historical aspect of the problem

This conflictual situation derives from the type of Man-Nature relationship which still has the upper hand in modern Western thought and which is based on the dichotomy subject-object, being-reality and reason-nature.

This concept, already existent in the classical Greek world, was increasingly consolidated from the seventeenth century onwards and, as AUTIERIO (1991) says, it induces the consideration of man on the one side as the subject who knows and reality on the other as an inert object, modifiable and at the disposal of the 'knowing' subject. According to the Cartesian perspective, the universe is *res extensa*, a machine to be used to glean outputs, whether material or immaterial. Technical expertise is the means by which Man puts this use into practice.

From the time of KANT onwards, this parable was subsequently completed as the theory of the ethical autonomy of the subject took root, that is to say, of the power claimed by human reasoning that makes man a law unto himself without objective references which transcend him.

Among other things, this has had the result of restricting the adoption of ethical categories to the human race alone in

that the perception of man as absolute sovereign of nature and of his own existence has gained more and more ground.

BENTHAM and MILL's ethics of consequentialism, which developed through the cultural climate of positivism, also point in this direction; determinate actions acquire the criteria of rightness only from the calculation of the benefits that would presumably derive from carrying out such a choice. From this outlook, a forest is worth as much as it produces, both as timber and as other products which have a market, or else as assets which are not easy to monetise, such as oxygen, wild animal life, recreational areas, landscape, etc. Forest conservation and the safeguarding of its functionality are needed as they are functional in perpetuating the flow of benefits that can be so gleaned (see *Kielwassertheorie* of the German school of forestry). «Modern» management which is economically sustainable, in the same way as multi-functional forest management which is as much in fashion, comes under this tradition: both are «output-oriented» (GLUCK, 1994).

However, a second often neglected ethical outlook has always existed in European culture. It harks back to the most authentic reading of Jewish and Christian religious traditions with regard to knowledge of the Man-Nature relationship. Similarly to the interpersonal relationship both with fellow creatures and with God, this is seen as a relationship of love, i.e. of the search for and the respect of the truth of that which is other than oneself. On the ethical and practical level, this induces us – paraphrasing AUTIERIO (1991) once more – to replace the dualistic concept and hermeneutics of contraposition in view of domination with a rediscovered *polarity*, which is, contrariwise, oriented towards solidarity and the sharing of destiny and requires further reflection regarding justice, with its boundaries going beyond the exclusively human horizon.

Points of contact with this position can today be found in some environmental philosophers who, while they do not

deny man's centrality, propose that human action should also take nature's rights into account. Indeed, international agreements, such as the Helsinki convention (1993) ⁽¹⁾, may be seen as the recognition of the value of extrahuman natural beings.

Pursuing this perspective, founded on the recognition of the value of nature which is intrinsic and not just instrumental, can lead to ethical references useful in forest management which is no longer only determined by the quest for the maximum flow of profit from the forest to man. But we must not go to the opposite extreme of constant denial of the lawfulness of silvicultural operations. It is essential, then, to pause a moment and reflect on the reality of the two terms of the problematical man-forest relationship.

Who is man in relation to the forest?

Man is a part of nature, of that self-same nature of which the forest is also part. He, however, has unique characteristics by virtue of which he finds himself with a particular role to play in the cosmos: he is endowed with self-awareness, reason and freedom which render him capable of understanding the intrinsic order of nature's complexity and of choosing how to transform it in accordance with his own plan. In this way, man has humanised nature through the course of history

(1) On that occasion, thirty-four European states undertook to implement sustainable forest management (which the world conference at Rio di Janeiro in 1992 hoped would be achieved but did not define), where this term was intended (resolution H1) as «the stewardship and use of forests and forest lands in a way, and at the rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems».

and has constructed civilisation in its various expressions. It is thus that, in the march of time, silviculture was born and grew.

Especially over the past century, however, it gradually and dramatically became clear to man that the freedom he had of disposing of nature is not absolute. So that life may continue to be possible on Earth, it appears particularly essential that the area of forest on the planet should not diminish any further and that the biological functionality of what still remains should be increased as much as possible (MARINI BETTOLO, 1993). This is what the natural laws state, or rather (as we say today) what is stated by the uniformities governing nature of which man is a part. These are uniformities that he can understand but has not established and cannot disrupt as his freedom too often tempts him to do.

In his «Oeko-Philosophie», SKOLIMOWSKI (1989) emphasises that the desire for improvement, perfection, transcendence is a main structural support for the human being, a moral need. However, it must be joined not only with respect for the individual as an end and never as the means, but also with the primary need to conserve and improve his living space. Hence, a truly wise action which is authentically human requires that every action be evaluated with particular attention to the degradation that it may introduce into nature.

What is the forest in relation to man?

As far as the forest is concerned, it is a complex system, endowed with complex uniformities. Still, these cannot be conceived simply as biological rules which are readily available, but they are to be inserted in that rational order according to which man is called to direct and regulate his life and actions. In other words, they establish rights and duties.

Do such rights and duties, therefore, directly concern the forest as well, as is claimed in various sectors? Rights and duties are actually the property of the human individual alone inasmuch as he is a responsible subject. Accordingly, the rights of the forest are to be led back to those of the human individual.

The forest's right to be cultivated according to laws characterising its vitality as a complex biological system is based on the duty of man to keep united the dimensions of his being an individual. His spiritual dimension, i.e. his peculiar capacity to make free, rational choices for a given end, together with his physical dimension award him a community of interest with the forest and with the entire natural environment he lives in. Man's free acts cannot go against natural laws because they would be acts against his physical being, against himself. When man does not respect nature's particular dimension, his actions become not only unnatural and against nature, but also inhuman and anti-human (AUER, 1988).

For this reason, the contradiction between economics and ecology is not inevitable. A correct approach to ecology cannot avoid considering man as an active ecological factor; man's activity animates the economy, but this must not go against ecology or it will destroy him. The duty of the forest to offer itself to man must also be led back to the nature of the human individual, so that man's life, in its biological and spiritual aspects, may grow and aspire to fullness, which also includes the humanisation of nature.

Destroying nature signifies depriving human culture of its essential substratum. But, on the other hand, making nature absolute, separating it from human culture on the presumption that the one does not need the other means depriving it – no less violently than he who would destroy it – of its natural destiny (LEONE, 1992).

Some positions of the contemporary environmental movement aspire to a more or less marked absolutisation of nature, even so far as to attribute the same value to all natural realities. From these perspectives, the unity and uniqueness of the human individual cease to be a determining ethical criterion. Actually, the result is often an accentuated abstraction and impracticableness of political and management proposals.

Humanising nature means transforming it into an environment where man, every man, can live, work and organise himself in society, with his own creativity activating the creativity of nature (PRZEWOZNY, 1992). It is clear that this calls for a positive outlook on the part of man, who seems to vacillate continually when faced with the facts of history and current affairs and the drama of death, which, under the surface, is inherent in his deepest truth, in the ultimate meaning of his existence, which he is never the one to grant himself.

Development of silvicultural management

The forest today, then, must be preserved and improved. And what would there be for silviculture to contribute to the matter, if it were only concerned with drawing benefit from the forest, preferably with the highest profit possible, and if in so doing the one continually risked degrading the other?

We simply cannot deny the strong influence that the timber companies' economy has on silviculture and on its practical application through management. All the same, in the evolution of forestry thought over the last three centuries, one is aware of the slow headway that a fundamental conviction has made: even when man chooses to cultivate the forest to reap the maximum profit from it, his freedom to dispose of it as he wishes is not absolute. The fact that it is so-called

naturalistic silviculture to assert itself, often in opposition to so-called «tree-crop» silviculture (even though it is on an ecological base), represents the clearest sign of the need to look at nature and imitate her processes if we wish to maintain forest equilibrium.

Progress in ecological science and crisis in the environment make a further step forward urgent. The systemic reality of nature requires that forest management be freed from strict models of reference, however they are intended. Their application tends to bring simplifications in composition and structure to the ecosystem which diminish its functionality, jeopardising the role that the forest plays in maintaining life on Earth. Ecological advances make a trend to favour adaptive, flexible management which is modulated on the diversified reality typical of each single forest and based on the control of the effects that cultivation operations have on the system's complexity, biodiversity and capacity for resilience.

In this perspective, *confrontation with uncertainty* becomes a fundamental aspect of wise action.

The ethical dimension of silviculture

In conclusion, this appears to be the ethical horizon typical of silviculture: the forest (and nature in general) is not simply raw material in the hands of man, devoid of any meaning or moral values until awarded a project of his, attributed with functions, or an order (conceived in absolute *creativity*) concocted for it. Silviculture must guide the planning and operative actions of man in the forest with respect for the forest ecosystem's complexity, its structural diversity, its dynamic forces, its equilibria with other surrounding ecosystems.

The technical ways for pursuing this ethical perspective in

silviculture are multiple and not necessarily new. What is urgent is the prospect of action to be taken. In practice, silviculture must be freed both from the subordination to profit maximisation by the timber company and from conservationist preconceptions. Both of them falsify the relationship between man and the forest. Naturally, man uses the forest through silviculture; he gathers wood, may create areas which are more pleasant for recreation and, can obtain an income. In the same way, in some cases, the suspension of all intervention can come under the canons of good silviculture. The forest must be the one to suggest the most suitable choice – the forest as read by science and the forester's conscience.

This is why the ethical rule of respect for the intrinsic value of the ecosystem is implemented by means of a relationship of care, proximity, familiarity and love between man and the forest which can alone favour deeper knowledge; on the contrary, it is disregarded by any form of abandon or *a priori* immobilisation.

To deny man the chance to interact actively with nature would only end up by increasing the already deep gap that divides the two subjects in today's society.

REFERENCES

- AUER A., 1988 – *Etica dell'Ambiente*. Editrice Queriniana, Brescia.
- AUTIERO A., 1991 – *Una speranza per il nostro pianeta*. In: «L'etica nelle politiche ambientali». Gregoriana Libreria Editrice, Padova.
- CIANCIO O., 1981-82 – *Le specie forestali esotiche e le relazioni tra arboricoltura e selvicoltura*. Annali dell'Ist. Sperimentale per la Selvicoltura, Arezzo, vol. XII e XIII: 1-100.
- GLUCK P., 1984 – *Criteria of sustainable forest development*. EFI News, 1: 3.
- LEONE S., 1992 – *Etica dell'ambiente*. Rivista di teologia morale, 3: 339-349.

- MARINI BETTOLO G.B. (ed.), 1993 – *Man and his environment. Tropical forests and the conservation of species*. Pontificiae Academiae Scientiarum Scripta Varia, 84.
- PRZEWOZNY B.J., 1992 – *Il rispetto dell'equilibrio dell'ecosistema come necessità etica*. In: SGRECCIA E., MELE V. (eds.), *Ingegneria genetica e biotecnologie nel futuro dell'uomo*, Vita e Pensiero, Milano: 279-298.
- SKOLIMOWSKI H., 1989 – *Oeko-Philosophie. Entwurf fuer neue Lebenstrategien*. Karlsruhe.

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WHAT KIND OF SILVICULTURE?

WHAT KIND OF SILVICULTURE?

In the history of man, ever since ancient times, the tree has been an important presence in the individual human conscience and in popular fantasy. A symbol of life, warmth, shelter, victory and peace and a reassuring, often magical element in fairy stories, the tree inspires respect because of its greater age and the certainty that it will almost always outlive us.

Much more than a simple group of trees, the forest exponentially increases the tree sentiment in the human spirit. Nevertheless, the forester cuts down the trees in the wood. When witnessing a felling, he has learned to quash the tremor in his heart at the creaking of the tree while it gives way and at the crash as it falls. Because, as we know well, silviculture is implemented especially with a chain saw.

Why, then, do we practice silviculture? We must keep on asking ourselves this question, because perhaps never before today, have so many accusations and so much controversy been turned against this activity of the forester.

But, in my opinion, the answer is simple and immediate. Even today, silviculture must be practised, that is to say, it is necessary «to cultivate the forest» in order to obtain a product, given that this product, timber, is in considerable demand (and rightly so).

The most glaring reason for silviculture can thus still be found in the most traditional function of the forest, that of «production» (the acquisition of a material product). No longer considered the pre-eminent function (or at least not always), it is probably the only one which still today justifies

and supports «forest cultivation» (others, which in many cases are rightly considered more important, could even do without it). However, this point of view has been altered a little with respect to what was the case not long ago: there is no longer the will (or at least not only so) to justify this production with the economic returns due to the owner. This concept of the productive function which is economical in the strict sense of the term (i.e. to return a profit from the soil capital), could even be considered old hat. The fact remains, nonetheless, that the demand for timber is still significantly high and, indeed, arboriculture for wood production (*tree farming*) on its own is currently far off the target to satisfy it completely. It is certainly not proper to correct the deficit by importation (if we remain in an Italian national context), thus palming the issue off onto other countries, especially those which still have virgin forests. Indeed, if cutting down the forest is a question regarding the environment (something that I believe none of us doubts), it is certain that state borders are not justified in terms of environmental ethics.

The high demand for wood products (which presumably is bound to remain so in the future, as well) is explained by the varied uses, both old and new, that this material is put to. Even he who would rather not see trees felled is in part responsible for these uses because he loves «natural» houses and objects – wooden furniture and parquet flooring.

But he is not wrong: as our instinct tells us, the choice of wood as a material for use and consumption is truly an «ecological choice». It is, in fact, a raw material which is produced in the forest by using up «clean» energy which costs nothing, that is to say, radiant energy from the sun («forests are the Earth's principal solar panels»: HELLRIGL, 1995).

Timber is a resource which is renewable in a relatively short time. It is a raw material which does not require a high expenditure of energy in its felling, preparation and primary

transformation, unlike other alternative materials. It is, accordingly, a resource with a low cost to the environment. Indeed, its yield provides undeniable benefits regarding the environment, the most important of which are oxygen production, the purification of carbon dioxide and the retention of carbon.

Thus, timber production improves the quality of the environment and its use, rather than that of other resources, helps limit certain environmental damage. To me, this seems a valid reason for continuing to exploit a part of the timber produced in the forest, applying ecocompatible criteria – no longer only in the name of «economic realism» in the sense CIANCIO (1991) gives to the term, but also – and indeed particularly so – in the logic of «ecological realism».

The important thing is to guarantee the forest its condition of *renewable resource*. But we know that this is also one of the purposes of silviculture, i.e. guaranteeing the forest's perpetuity and dynamic conservation through silvicultural systems.

It cannot be denied that the current reality with regard to the forest in Italy is that of cultivated woodland. Forests, here and in Europe, are emerging from centuries of cultivation, whether it has been good or bad, from situations of past exploitation and of *compromise* at the present moment. This compromise, chosen by man, has essentially been the replacement of the natural equilibrium with a cultivation equilibrium (CAPPELLI, 1991). The permanence in these woods of the system which distributes assets and amenities is also obtained by handling a chain saw.

Permanent regeneration of the forest, or at least in cycles comparable to the human life span, is today guaranteed in our forest reality precisely by good silviculture.

So, mature trees are cut down with a view to conserving the forest. This justifies the practice of marking trees for fell-

ing, too, and it is precisely this awareness that allows the silviculturist to quash his tremor as the tree crashes down. This is that «conceptual passage so dear to the forester», as PACI (1994) so aptly points out, where «the concept of the tree is replaced with that of the forest». Because «trees – as much in natural forests as in those cultivated on a sustainable basis – are transitory guests of the forest, which remains dynamical-ly unchangeable, eternal» (HELLRIGL, *in verbis*).

The «happy coincidence» that can be found in regeneration cutting is just this: that, if correctly carried out, it concurrently guarantees timber utilisation and forest perpetuity. For this reason, it remains a distinguishing and unforsakable operation in silviculture.

So, if the need to cultivate the forest is motivated by the need for timber, then we are, in any case, comforted by another piece of knowledge: if the forest is cultivated with wisdom and skill, not only will it guarantee a material product, but, in a measure more or less comparable to natural forests, it will provide all those indisputably recognised services and utilities which comprise the peculiar characteristic of multi-functionality and which, unlike others, this production system possesses. They are the different non-material aspects which, in these times of floods and afflicted as we are with urban «giddiness» (CIANCIO, 1993), we are so keen on.

In our days, there is also a kind of «mandatory silviculture» that I wish to define as «restoration». This contemplates all those operations aimed at correcting errors and horrors from a quite recent past, i.e. with the purpose of restoring and improving the forest. Among these are the conversion of coppice to high forest, the restoration of compositions in their original state, the reintroduction of «noble species» and reforestation.

I do not wish to linger on this kind of silviculture, despite the fact that it includes the activities that most appeal to pub-

lic opinion. Although necessary, it is temporary and bound to the contingency of the moment. It does not touch the essence of silviculture and maybe, at a future moment that we all long for and hope is close, we can consider it superseded.

Wood production, conservation and (at the present moment) improvement justify the practice of silviculture in our forests. As a consequence, I believe that the choice for or against silviculture, which is of a political nature, is almost compulsory: that is to continue cultivating the forest. Naturally, silviculture must be backed up by adequate arboriculture for wood production and this must be increasingly stimulated (as, in actual fact, is the present trend in European Union policy).

But another important decision has become necessary in the planning line. This relates to *where* silviculture is to be carried out. Accordingly, it is not so much a question of «yes» or «no» to silviculture, but rather «where yes and where not».

The first category of forest where we would all like to ban silvicultural activity is that of the virgin forest. But in our beloved homeland, where this is missing completely, nobody raises the question. But one can choose to leave to natural evolution, enclosing them within integral reserve areas, those forest communities that are considered to be particularly close to primary conditions, or of singular naturalistic value because very characteristic or with rarity value. The same can be applied to stands where one wishes to study and investigate the system's natural dynamism.

We will avoid any cutting in all formations having insufficiently stable equilibria, either because they are in extreme ecological conditions or because they have suffered serious alteration. In practice, this means in all those forests which are «too poor to give wood to man» (HELLRIGL, unpub.).

On the other hand, in the domain of forests which have

been previously or recently cultivated, we will choose to go on using what we recognise as having sufficient resilience to be able to withstand a reasonable removal of biomass by man, i.e. wherever the forester's actions can truly be considered an «ecocompatible activity», and where correct silvicultural systems and wise cutting regimes will be particularly attentive in preserving the forest's multi-functionality. At the same time it will provide timber and regenerate the forest in a relatively short time, thus guaranteeing continuity to the productive system.

So then, *what kind of* silviculture for this purpose?

This is the third decision-making moment, more precisely related to cultivation (but also quite cultural!), which directly involves the silviculturist: one must establish *how* to intervene.

At this point after decades of debate and experience, the path to follow can only be, for most of our high forests, along the lines of silviculture according to nature.

«To imitate nature and hasten her work is the essence of silviculture». This fortunate insight of PARADE's, which goes back over a century, was echoed just a few decades later by GAYER, who claimed that «the secret of forest production lies in harmony with the natural forces operating in the forest».

In the past, the various currents distinguishable in the sphere of «naturalistic silviculture» put forward the following main points: resorting to natural regeneration, preferring mixed compositions; attempting to create a permanent cover; and articulating structures until they became uneven-aged. The aim of all this is to attain, in one way or another, the biological stability of the forest and its capacity for self-regulation. The cultivated forest must be as self-sufficient and as autonomous as possible.

In any case, a forest cultivated according to naturalistic principles still remains a sort of *compromise*, where equilibri-

um maintained by cultivation partly makes up for natural equilibrium. Increased returns from the system are obtained by man's partial simplification of the trophic structure to his own advantage and to the shortening of the productive cycle, by imposing cultivation maturity (SUSMEL, 1976).

Today, the Swiss are still convinced followers of the naturalistic current, which has by now permeated all silvicultural practice in Central Europe, including the Italian side of the Alps. The province of Trento, for example, can now boast several decades of «invisible silviculture» on a naturalistic base, following CRISTOFOLINI's teaching, and other Alpine provinces and regions are moving in the same direction.

Silviculture according to nature is, first of all, an idea or ethical principle which, however, is not translated into any precise cultivation technique.

The guiding principle remains the classical one, that of «imitating nature» (and not just because it guarantees success but also through moral choice). This principle, should culminate with the adoption, for each forest typology (DEL FAVERO, 1992) of the modes of generational turnover that are followed by nature (although not always with the same space pattern and time cycles).

Given the extreme variability in forest types and habitats in Italy and considering that, as LEIBUNDGUT (1973) puts it, «every kind of silvicultural system, ranging from selection felling to clear felling, could find its prototype in the virgin forest», this also means following a «free style» in silviculture (KOESTLER, 1953) in many cases, or else a «free approach in felling» (LEIBUNDGUT, 1984). Rather than the adoption of the traditional technique over wide areas, it ends up reproducing the way nature operates (at least in forests under temperate climates).

However, this also means, in the concrete activities of management and planning, the abandonment of «maximum systems» in silviculture, because, being free from dogmatic

restraints, this likewise signifies «imitating» nature. As early as 1966 CRISTOFOLINI suggested «no rotation and no maximum felling diameter» in the name of naturalistic silviculture for Trento's fir-woods. Yet again, LEIBUNDGUT wrote that the forest's multiple functions presupposed acting in harmony with nature, which meant an irregular structure which had adapted to local conditions and was consequently not schematically regular.

Even in the sphere of relatively homogeneous communities, diversification in the silvicultural system has the advantage of spreading the risk due to the lack of certainties in our knowledge, and of lending flexibility to a productive system (be it goods or services) projected into a future which is not always so predictable.

AS CIANCIO and NOCENTINI so appropriately say (1994), naturalistic silviculture, like the silvicultural method in yield regulation, is also *operative freedom*.

But it is for this reason that knowing how to interrogate and interpret the forest is indispensable. More than ever, a particular sensibility, whether instinctive or mature, is necessary. The ability to grasp and consolidate the ancient and renewed threads of friendship between man and the forest is required. It has become outstandingly important to be able to come to an agreement with the forest, so that the compromise looks more and more like an *alliance*.

Still in the name of this conciliation, we warmly support the diversification of operations even over relatively small areas. By creating a mosaic of micro-environments and habitats, biodiversity is enhanced, fostering the establishment of genetically different species and individuals even within territories of limited extent.

In this way, no autochthonous species, whether animal or plant, will in theory be precluded from establishing itself and manifesting all its genetic potential.

Let us banish monotony, accordingly, in favour of diversity, of more articulate and animated structures and of complexity. This will also mean giving up certain reforestation projects and not forcing the conversion to forest of particular ecosystems with a weak vocation for forest status, accepting, for example, the presence of areas with xerophytic grasses or hydromorphic and peaty soils (HELLRIGL, 1995) and other formations which are not always welcome, at least in productive terms.

We will have to follow the laws of natural dynamics, concerning which there is an increasing need for knowledge, and not work only to the benefit of some forests. In certain cases, we must be willing to accept changes in the landscape. Lastly, we must try not to tie the utility of the forest to just a few forest types: in terms of timber production, by the way, if it is foreseeable that demand is bound to increase in the future, it is highly doubtful «what relations of value will exist between the various woody species in the span of a few decades» (LIEBUNDGUT, 1988).

Here are a few more recommendations to seal the alliance.

- Let us indeed entrust conservation of the forests only to the natural regeneration of local ecotypes, thus abolishing the use of exotic species or those not native to our mountains. These should instead be limited to arboriculture for wood production (*tree farms*).
- Let us try to impact the populations' gene frequencies as little as possible. We must not forget how tedious and risky and often unidirectional our selective action can be, even when simply carrying out «tending felling». With the process of marking, whether for a thinning operation or any form of regeneration cutting (except clear felling), let us try to rely a little on «chance» in our choices (and we should not always feel obliged to identify the «plus» trees).

- Let us leave all organic substances in the forest, respectful of the material's cycle, if we do not sincerely consider their removal to be of use. That is to say, where the fire hazard is not pressing or we are not concerned by attacks of bark insects, let us avoid cleaning and tidying up the forest no matter what, seeking an order which is perhaps commendable only to human eyes. Let us learn to feel the importance of the dead tree! (HELLRIGL, 1992).
- «No rotation and no maximum felling diameter» also means restricting human liberty in attributing a forced, egalitarian maturity to the tree: chronological or dimensional maturity first of all, is characteristic of the biotope and of the individual. In the context of an articulated structure, this also means that, at times, we may «forget» to cut down a tree, however old it may be, and leave it to its natural fate.

REFERENCES

- CAPPELLI M., 1991 – *L'equilibrio naturale del bosco*. 3-5 In: *Elementi di Selvicoltura generale. Governo, trattamento e cure colturali ai boschi*, 2^a ed., Edagricole, Bologna, XVIII + 389 pp.
- CIANCIO O., 1991 – *La selvicoltura oggi* L'Italia Forestale e Montana, 46 (1): 7-20.
- , 1993 – *Gli alberi e la città, il bosco e la montagna, simboli e metafore*. L'Italia Forestale e Montana, 48 (6): 384-390.
- CIANCIO O., NOCENTINI S., 1994 – *Il metodo del controllo e la selvicoltura su basi naturali: un problema culturale e di gestione forestale* L'Italia Forestale e Montana, 49 (4): 337-356.
- CRISTOFOLINI F., 1966 – *Il miglioramento della fustaia in Trentino* Annali dell'Accademia Italiana di Scienze forestali, 15: 239-272.
- DEL FAVERO R., 1992 – *Un'esperienza di studio di tipologia forestale*. Annali dell'Accademia Italiana di Scienze forestali, 41: 65-84.
- HELLRIGL B., 1992 – *Ipotesi di direttiva per la compilazione del piano di assestamento del complesso di Paneveggio - Pale di San Martino*. Redatta per conto dei Servizi forestali della Provincia Autonoma di Trento.

- , 1995 – *Ecocompatibilità e sviluppo sostenuto nell'assestamento forestale*. 15-24. In: *I boschi montani: un ecosistema, una risorsa*. Atti del Convegno, Brescia 13.2.1993, La Nuova Cartografica, Brescia, 92 pp.
- KOESTLER J.N., 1953 – *Waldpflege*. P. Parey Vlg., Hamburg & Berlin, 200 pp.
- LEIBUNDGUT H., 1973 – *Rationalisierung und naturnahe Waldwirtschaft*. Der Forst- und Holzwirt, 28 (18): 365-368.
- ., 1984 – *Die natürliche Waldverjüngung*. 2^a ed., Haupt Vlg., Bern & Stuttgart, 115 pp.
- ., 1988 – *Waldbau heute*. Haupt Vlg., Bern & Stuttgart, 119 pp.
- PACI M., 1994 – *Riflessioni su selvicoltura e paesaggio*. L'Italia Forestale e Montana, 49 (2): 220-225.
- SUSMEL L., 1976 – *Possibilità della selvicoltura artificiale nella regione mediterranea. Compiti delle selvicolture naturalistica e artificiale*. 142-150. In: *Problemi di ecologia applicata*. Università di Padova, Istituto di Selvicoltura, 201 pp.

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A RETURN TO COMPLEX FORMATIONS
THROUGH FOREST MANAGEMENT

The authors have contributed equally to this paper.

A RETURN TO COMPLEX FORMATIONS THROUGH FOREST MANAGEMENT

Forest conservation is a very topical problem, the object of debate at technical, scientific and political levels. The reasons can be found in the general awareness of the role and importance that the forest plays in the conservation of the environment. However, such a univocal range of thought is not reflected in the same way in the concept of the meaning of conservation and, consequently, in the criteria for putting it into effect. This is often because the object to be conserved escapes us.

In the case of forests, some hold that conservation is synonymous with the refusal to intervene in any way. Others maintain that conservation is only possible through management. In both cases, the need to conserve is acknowledged, but the fact is often overlooked that what we wish to conserve is not natural and that the present state of affairs in many forests is the result of man's activity which, whether directly or indirectly, has conditioned its natural evolution.

SUSMEL (1988) wrote, «Talking of naturalness with regard to forests would have been senseless many centuries ago, even less is there any sense in it today...».

An examination of two typical situations of the mountain environment could give a better idea of the problems and options raised by the management and conservation of forest ecosystems. The first is mixed beech and fir stands, relating to the whole Apennine range, the second, forests of Calabrian black pine, limited to the Sila and Aspromonte mountain ranges in Calabria.

Beech, silver fir and (restricted to Calabria) Calabrian black pine are the three species which schematically characterise the mountain forest of the Apennines. Over the passage of time, they have shown considerable variation in terms of both the area covered and the proportion of each species in mixed stands.

The mixed beech-fir forest, typified by the significant, qualifying presence of silver fir has, even in the recent past, played a role of considerable importance in historical, cultural, biological and silvicultural terms. And, on the basis of pollinic analyses, historical documentation and phytogeographic and ecological studies, it has been proved beyond doubt that it had a greater distribution in the past than now.

The intense exploitation of stands without being backed up by appropriate silvicultural operations, and grazing have caused a reduction in the presence of fir in many areas, with the consequence that the species composition has been simplified, the degree of stability altered, and the functionality of the system attenuated.

Characterised in the current phase by a distribution area which is very fragmented, silver fir is confined to true refuge areas. Even though it is present over fairly wide areas in some zones, it has minority status with respect to beech. The result is that pure beech stands, today vastly dominant, and fir stands, hardly extensive at all, represent simplified formations compared to the original mixed phytocoenosis.

The second example is that of Calabrian black pine forests, present on the Sila massif and in the Aspromonte, in a vegetation area lying between that of deciduous oaks and beech. The wide distribution of this species which, together with fir, black poplar, ash, beech, etc., formed the Bruzi forest, is the result of the large-scale clearing which was initiated by the Romans for industrial reasons and continued by the local populations, principally to acquire new land for cultivation. In

1770, GRIMALDI pointed out how the immense timber consumption carried out in Calabria *for kitchen use* had led to the destruction of the forest, including oaks and other timber necessary in domestic economy. In the same period, ZURLO pointed out that, in the year 1790 alone, 976,000 young pine-trees and 977,000 adult plants were destroyed by fire or felling on the Sila plateau, which «had for a long time constituted the most important of the State forests in the Kingdom of Naples» (LAMANNA, 1783), with the consequent unlawful cultivation of no fewer than 7,250 hectares. And this happened despite a proclamation issued over the same period making it compulsory to re-establish the preceding forest stands over all land which had been cut over and cultivated unlawfully. In many districts where the forest cover had been cleared to obtain fertile land for farm crops, the washed-away fields remained sterile and the streams, that had become more uncontrollable in the meantime, devastated underlying land (SPIRITI, 1793).

Over the centuries such a use of the forest and the consequent exploitation of the soil have led to a noticeable dwindling of forest areas on the Sila plateau on the one hand, and, on the other, have determined favourable conditions for the regeneration prevalently of Calabrian black pine. So it is that the pine forest, like other formations of black pine (which in various spots throughout the Mediterranean region and in similar conditions have covered vast areas) is generally considered today to be just the first stage, albeit a long one, of an evolutionary process towards different formations. This is because the evolution towards mixed beech-fir forests at higher altitudes and oak forests lower down is so slow that the pine stands can be considered a permanent formation, as FENAROLI and GIACOMINI (1958) wrote. In many cases, the evolutionary process is also conditioned by silvicultural operations, such as clear felling, which may impede it to the extent of blocking it altogether.

In the two examples reported above, some of the secondary species, natural components in mixed forests, are quite rare. They are often confined to valleys or inaccessible areas; sometimes they have completely disappeared. All this clearly demonstrates that both pine and mixed beech-fir forests are formations which are simplified in their composition and altered in their structure.

Calabrian black pine forests are, in their present range, partly the result of soil degradation which has led to their dissemination. Certainly the creation of the Calabrian National Park was itself also directed at preserving these formations over the passage of time.

With such a hypothesis, maintaining Calabrian black pine forests as they are means conserving forests which are strictly dependent on man's activity because they answer to demands of an economic and financial nature or to those of tourism and landscape. Accordingly, conservation of the pine forest in its current aspect, structure and consistence may not be divorced from the actions of whoever induced it, i.e. man. This resolves in a view of the forest as an instrumental entity.

If the objective of renaturalisation is the evolution of stands towards systems where a high level is reached in the mechanisms of relational organisation between all components (not just the trees) and between these and the physical environment (CIANCIO and NOCENTINI, 1994), then the codes of conservation change and subsequently the aims and functions of man's activity in the forest do too.

Hence renaturalising is perceived neither as a return to the origins nor as the restoration of «natural forms», but as operations carried out with the aim of fostering the evolution of the system towards more complex forms.

In this perspective, if one admits that Calabrian black pine forests are mostly the consequence of the application of certain silvicultural systems, then one must admit that a renatu-

ralising process should allow evolution towards formations which are more articulated in their composition and structure.

This is an evolutionary process that will not lead to the total elimination of pine forests since these will still cover a part of the current area in situations of degradation which linger on and which will always be present (consequent to fires, slope erosion, exceptional meteorological events, etc.); rather, it will result in a reduction in terms of total area.

This evolution, in the past hampered by man, is already particularly obvious in the territory of the Calabrian National Park following the suspension of all exploitation, except for the removal of decaying and dried trees for protection against parasites.

This type of management has modified the forest micro-environment in favour of the regeneration of beech trees at higher elevations and deciduous oak trees lower down. These broadleaves have locally invaded the pine stands in a significant way.

Together with beech, fir may also regenerate and assert itself in due time (in fact, it is already present in small groups scattered in beech stands) together with other broadleaf species such as common maple, mountain ash, etc. which have survived in some zones. Lower down, Turkey oak, Italian oak, opalus, field and common maples, black alder, chestnut, hazelnut, etc. will form mixed stands.

As evolutionary processes are under way in both cases, man's intervention might not be indispensable.

Where, on the contrary, these phenomena have not yet been triggered, well-directed silvicultural intervention is helpful in favouring the establishment of optimal environmental conditions which would come about anyway, but only after a long period of time. This should take place without the system being caused stress which is hard to assimilate.

late and without causing adverse conditions for naturalisation.

It all comes down to a silvicultural approach that CIANCIO (1991) has defined as *cautious, continuous and capillary*, free, that is, from any rule or design, which permits seedlings of prevalently broadleaf species to grow under cover. After that, it will be enough to follow the evolution until the system becomes self-sufficient.

In the scenario represented here, the renaturalisation of Calabrian black pine stands inevitably leads to deep changes in the current physiognomy of the forests on the Sila plateau, to the redistribution over vast areas of broadleaves typical to the various environments and to the reconstitution of mixed forests.

Regarding beech forest with fir, the problem is in the same terms: these profoundly simplified phytocoenoses demand reconstitution in composition and in structure. Man's intervention may be superfluous in forest communities characterised by a significant presence of both beech and fir, where the system's internal evolutionary dynamics is well-developed and active. The forest is certainly able to regulate and organise itself towards still more complex equilibria on its own.

However, the cultivation systems that have been applied in most cases have determined a reduction in fir participation in phytocoenosis. Such systems have proved to be poorly efficacious in conserving the mixed beech-fir forest. Indeed, they have almost always led to the formation of pure beech stands, or else stands where beech decidedly prevails.

The classical silvicultural systems either do not permit the upkeep of the stand's mixed composition, or else they cannot be applied yet because the necessary conditions for their correct use are lacking. It is therefore necessary to resort to other forms of silviculture. A critical analysis of

field observations provides useful indications and suggestions: it is sufficient to comprehend the language of the forest and grasp the profound significance of the interactions in order to rationalise them in appropriate cultivation operations which are directed at achieving a mixed beech-fir forest.

Accordingly, renaturalisation presupposes intervention which, within the ecological range of the species, favours the phenomenon of fir regeneration, and the development and growth of the seedlings. Although not numerous, there are enough old fir-trees to allow the species to be re-distributed. Examples are manifold.

For this to happen, it is, however, indispensable to lay on a series of operations in the areas bordering these groups of firs. Initially, optimal conditions for the establishment and growth of fir and beech seedlings should be created. Then it is necessary to regulate the admixing between the two species, avoiding the prevalence of one over the other. Then, also in this case, the system's organisation could be left to the sole force of Nature.

The chances of the natural regeneration of the secondary species present, especially maple and yew, typical of beech and fir forests, definitely appears more difficult. In some cases, it will even be necessary to intervene directly so as to speed up the process which is otherwise extremely slow.

Renaturalisation of two typical formations on the Apennine mountains, such as the Calabrian black pine forests in Calabria, and the beech forests will therefore mean a transformation of the forest landscape. This transformation, while complying with the same logic, that of reconstituting complex systems, leads to the reintroduction of mainly broadleaf species in one case and of conifers in the other.

In short, if we wish to preserve the present forest land-

scape, it is enough to carry on with traditional silvicultural techniques, but if we wish to trigger evolutionary processes, then we must proceed differently.

To sum up, the situations we have examined go to show how, in forests altered by anthropic action, conservation must be practised through forms of management aimed at reconstructing what has been modified over time.

Such management must of necessity free itself from the criteria adopted till now in cultivating the forest (perhaps we had better say the forest trees) to satisfy the demands of man which differ every time (production, protection, recreation and today the accumulation of CO₂) and must embark on operations which, as CIANCIO and NOCENTINI (1994) write, are always in support of the forest and in its interests. This is because the forest is an ecosystem and as such, its structural character and functionality render it a complex system. Consequently, management cannot confine itself to applying a given form of cultivation nor can it depend on predetermined regulations (CIANCIO, 1992), but it must act so as to mitigate man's impact on the forest. Management must, therefore, be bound to renaturalising the forest, which can come about, as CIANCIO has been advocating for some years (1991), through applying cultivation modules of a non-linear kind.

REFERENCES

- CIANCIO O., 1991 – *La selvicoltura oggi*. L'Italia Forestale e Montana, 46 (1): 7-20.
 –, 1992 – *La questione forestale italiana. L'orizzonte possibile*. L'Italia Forestale e Montana, 47 (6): 321-339.
 CIANCIO O., NOCENTINI S., 1994 – *La gestione forestale nelle aree protette*. Linea ecologica, 26 (6): 10-13.
 FENAROLI L., GIACOMINI V., 1958 – *La flora*. Touring Club Italiano. Milano.

- GRIMALDI D., 1770 – *Saggio sull'economia campestre per la Calabria Ultra*. Napoli.
- LAMANNA G., 1783 – *Considerazioni politico-economiche su la necessità e la direzione dell'agricoltura nella Sila*. Napoli.
- SPIRITI G., 1793 – *Riflessioni economico politiche di un cittadino relative alle due provincie di Calabria, con un breve prospetto economico della città di Messina*. Napoli.
- SUSMEL L., 1988 – *Principi di ecologia*. CLUEP. Padova.

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FOREST MANAGEMENT BETWEEN
ECOLOGY, ECONOMICS AND ETHICS

The authors have contributed equally to this paper.

FOREST MANAGEMENT BETWEEN ECOLOGY, ECONOMICS AND ETHICS

*Even in nature there are ugly things
but nothing is a surplus*

Yolanda Oreamuno

1 – *The bio-economy of forest systems*

The argument presented here will seem eccentric to some, unorthodox to others. Indeed, it does not comply with what foresters are accustomed to. As a rule, they consider forest *preservation* and *conservation* to be management categories concerning integral reserves and protected areas. In this paper, on the contrary, we maintain that *preserving and conserving forests are two forms of forest management*. As GREGORY BATESON would put it, two sides of the same conceptual coin.

On one hand, the issue concerns the new scientific paradigm which has taken shape over the last few years and which has asserted itself in the biological sciences – and not only in these. On the other hand, it represents a workable outline for research based on the systemic concept of the forest. This involves an attempt at determining and analysing the structure which links forest management to the three E's – ecology, economics and ethics. In other words, we will proceed to innervate the connecting tissue interposed between forest systems and the three E's, and give it a plausible interpretation.

The forest comes under the group of highly complex systems. But it is precisely due to this that it displays organisational patterns which are still scarcely known, and it mani-

fest natural behaviour patterns which are hard to understand. As with all living systems, the forest is characterised by the unpredictability and indeterminate nature of its reactions and plurality in the feedback mechanisms. In short, it is modified by the environment and, in turn, affects the environment altering it. The level of such modification depends on the degree of autonomy that the forest has with regard to its environment. That is to say, in relation to its internal coherence.

But this is not all. In changing, living systems tend not only to optimise, but also (as FRANCISCO VARELA would say) to conserve their adaptation. Ecology, economics, ethics and the forest system indicate three interconnected moments. The first refers to maintaining adaptive mechanisms at elevated levels and to conserving the efficiency of evolutionary processes. The second relates to the system's management. The third concerns intrinsic values of the forest and man's behaviour towards it. In short, such moments represent the relational phenomena which define the *bio-economy of forest systems*.

Before any further considerations, it may be useful to indicate the strategy employed in dealing with this problem. It is articulated into three points. The first concerns forest management in its traditional form and the analysis of the underlying logic. The second involves interpreting the problem from a different perspective from the present one. The third represents a new conceptual approach. The intention is to help clear up a few controversial aspects in forest management and to verify what influence such an approach may have on the evolution of forestry thought.

2 – *The classical model of forest management*

It is commonly held that the term «management» stands

for a series of technical and administrative activities which pursue economic returns. In this sense, forest management – an asset of public interest (CIANCIO, 1988) – plays up the so-called *direct and indirect benefits* (PATRONE, 1944). Over the years, forms of management which pursue the aim of optimising forest production, while also allowing forest continuity have been devised and defined.

This way of managing the forest is part – how shall we put it? – of the genetic and cultural heritage of foresters. So one may well ask the reason for this specification. The reason lies in the fact that foresters assimilate forest management to a complex of operations aimed at maximising soil rent. Just one way to bring silviculture, forest management and forest economics into the large channel of scientific, intensive, mechanised and industrial agriculture. Cultivation methods and systems change, but the task at hand is the same: the exaltation of the technocratic and productive principle.

Comparing agriculture with forest management on the terms given above may seem paradoxical to many or, at the best, a concept stretched to the extreme. But that is not the case. Careful analysis shows that such a comparison is coherent and significant. What is more, it adequately upholds the supposition on which traditional forest management, along with the underlying business logic, is based.

In recent years, forest management has taken on a wider and more general significance. It comprises both distinctive and descriptive elements and new planning procedures. Thus the question leads back as to whether the business logic of profit is accepted or not. By accepting this logic, management is linked to positive financial returns; if, however, this logic is not accepted, on the one hand management poses ethical problems and on the other it escapes technical competence, returning to the sphere of decision making of a political nature.

3 – *What is not forbidden is allowed.*
What is not allowed is forbidden

Forest management, conducted according to the classical model of profit, has produced results of considerable scientific, technical and economic interest. It has acquired a precise value. It has defined the minimum conditions of cultivation, i.e. it has established wide limits within which forest exploitation is possible. A concrete example? The use of the forest for productive and protective ends is still regulated today by the «*Prescrizioni di massima e di polizia forestale*» (General rules and Police regulations). In other words, by proscriptive regulations: *what is not forbidden is allowed*.

Management of this type no longer corresponds to the demand arising from society. It is not coherent with common feeling which requires regulations preventing forest disturbance and imbalance. That is to say, prescriptive regulations: *what is not allowed is forbidden*. If this is the way things stand, one may well ask if forests must, or indeed can, still be managed. In other words, if management which aims at maximising soil rent or at optimising the multiple forest functions is in agreement with this new way of thinking. And, furthermore, if management based on the Cartesian and Newtonian outlook (i.e. reductionistic and mechanistic) is still possible.

A fact clearly emerges: except in rare cases (which, however, are not the standard) the present form of forest management satisfies neither on the technical nor on the economic plane, nor, above all, on the scientific, epistemological and ethical levels (CIANCIO and NOCENTINI, 1994c). Recent advances in knowledge in the fields of the three Es (ecology, economics and ethics) have facilitated new conceptual progress connected with forest management, and consequently, besides requiring a pause for reflection, have indicated the need for a choice between alternative solutions. The mere assertion that there is

a problem is in itself a sign. If nothing else, it does at least indicate a sense of unease and reveals a contradiction which is beginning to undermine even the firmest convictions.

4 – *Preservation as a form of management*

Can forest preservation take on the meaning of management? If preservation means safeguarding, protecting and defending the forest from possible or probable damage or hazard, then the answer is affirmative: preservation is management. In this case management is translated in the intangibility of the forest. In other words, if a system is not functionally efficient because of intrinsic or extrinsic problems and there is the desire to preserve it, then management must impose limitations to safeguard the system.

On the contrary, however, it has always been held that rapid, massive intervention is necessary when a system has seriously deteriorated, in order to bring it back to a level of efficiency. It is not appreciated that, in such a way, its evolution is strongly conditioned. From a systemic point of view, in order to achieve the desired objectives, it is not only useless to operate on the basis of observation of what happens in similar conditions, but it almost always provokes evolutionary deviation. Or rather, a drift the consequences of which become evident only after many years.

The reason for this is very simple: one of the invariants of natural systems is the *changing environment*. After the destructive or degenerative event, relationships and interactions between the system and the environment change. No longer do they act in the same direction and in the same way. The evolutionary dynamics tend to form a system which pursues a new equilibrium in connection with environmental modifications. Indeed, any intervention would only have the

effect of forcing the evolution of the system in an unnatural way. Damage would not be repaired, but indeed even more damage, perhaps more serious, would be added.

In practice, preservation is a form of *passive management*. Even though, strictly speaking, this is not so. Indeed, if the aim is not to modify, damage or block processes under way, then it is necessary to examine and, if possible, quantify the scope and rhythm of the evolutionary dynamics. After all, monitoring and analysing the internal and external connections which come about in the system are part of management and serve the purpose of acquiring further knowledge.

5 – *Conservation as a form of management*

Can forest conservation be absorbed into the concept of management? If by conservation we mean safeguarding the forest so as to prevent its exploitation, alteration, simplification or even disappearance, then yet again the answer must be affirmative: conservation means managing. In practice, management is achieved in three ways: one, by not touching anything, i.e. not undertaking any action; two, by undertaking actions but not significantly upsetting the system; three, by fostering the renaturalisation of the cultivated forest.

On superficial inspection, preservation and conservation could, in the first case, take on the same meaning and be used as synonyms. But this is not so. It was previously demonstrated that preservation is linked to severely deteriorated systems, while conservation has to do with efficient and functional systems. We must note, however, that different operative procedures do not always correspond to this distinction. In some cases, action along the lines of *passive management* in the above sense, is chosen; in others, as we shall see, action will follow different criteria.

In the second case (undertaking actions but not significantly upsetting the system), as man is part of the system and interacts with it, the aim is not to weaken feedback among the components of the system and between these and the environment. In fact, operations are carried out with conservative aims. Actions are conducted within and not beyond the limits of *flexibility* in the system. This is because, in a forest that has reached the status of functional efficiency, irreversible upheaval is caused every time a non-conservative operation is carried out. This distinction is crucial in the *bio-economy of forest systems*.

In the third case (renaturalisation of the cultivated forest), because uncultivated forests in Europe are rare, conservation consists, in actual fact, in the aware and careful management of the «anthropic» forest. On the one hand, conservation is useful in getting to know and in keeping up internal dynamisms, and on the other, it must trigger them off when structural simplification has reached intolerable levels. The renaturalisation of the present forest is a form of *active* conservation (CIANCIO and NOCENTINI, 1994c). This is for two reasons. The first is that it determines the level and degree of internal dynamisms: choices are made between various solutions and resultant operations are always in support of the forest and in its interests. The second is because characteristic features are likely to be changed and the forest's natural behaviour altered in the process of deterioration.

6 – *Autopoiesis and evolution of the forest system*

Since many forget, it is necessary to bring to mind that forest management does not always have to be (or even can be) carried out with a chain saw. There are alternative methods and tools which can keep forests in an efficient state or

render them so. In order to conserve or preserve forest systems, however, operations must, in any case, be carried out continually, though obviously at levels and in ways which differ from classical ones, though not necessarily (it must be stressed yet again) by taking wood.

In this sense, forest planning is absolutely essential. It represents the operative instrument through which theoretical dictates concerning the new perception of the forest are put into practice. Rules, limitations, cultivation suggestions and especially the conduct to adopt with regard to the forest are indicated. Nevertheless, how does one behave in actual fact?

When management aims at *conservation*, choices are made taking into account knowledge as to the functioning of the forest system. In certain cases, cultivation operations are not envisaged. In others, on the contrary, discreet and aware action is taken which implies the recognition of forest values. The idea is to try and favour evolutionary processes and to safeguard the internal coherence of the system. To put it more simply, bio-diversity is promoted, i.e. action is taken with the intent of increasing complexity and favouring structural «disorder».

Organisation, which is the invariant of systems, is thus enhanced; the *structure* is affected cautiously. The forest is left ample freedom for *self-management* or *autopoiesis*, a kind of «do it yourself». In this way, not only does man become the guarantor of the forest, but he also establishes a relationship of equality with it, defining and respecting its rights. In turn, the forest identifies itself in man who is an integral and internal part of the system. The task of the manager is to understand the ways in which structural and functional processes work. The question is not whether, but rather how. The system's morphology, physiology and conduct must be known and interpreted so as to improve its function, where necessary.

Conversely, when management means *preservation*, steps will be taken to issue prescriptive regulations which, as we have seen, are completely different from proscriptive ones. In this case, planning is useful in defining and applying such regulations; in monitoring, verifying and qualifying the course of the system's reactions and feedback; in analysing and quantifying the ontogenesis of the forest, and so on. All the rest is not allowed, which means strictly forbidden: opening forest roads; any kind of felling; silvicultural operations and reforestation, etc. Maximum *confidence* is accorded to forest self-organisation (CIANCIO and NOCENTINI, 1994c); in other words, *the system is left to its free, undisturbed evolution*.

7 – *The new conceptual approach*

If the forest is looked on as just an *object*, or a *machine* capable of providing commodities and utilities, then traditional management, with the underlying logic of profit, still has reason to exist. However, it must be pointed out that, in trying to remedy a management policy of exploitation, for decades now attempts have been made with compromise solutions based on the search for sophisticated silvicultural techniques. One point must be made clear: whatever technique is adopted, the productive function still remains predominant. And in order to avoid a lot of pointless as well as detrimental confusion, one must be aware that «naturalistic silviculture» is an emanation of the so-called «wake effect» (*kielwassertheorie*), as SCHULTZ also states (1990; 1991). As already stressed, this comes under the business logic of profit.

If, on the contrary, one looks at the forest as a *subject with rights* (CIANCIO, 1991; 1992; 1994; CIANCIO *et al.*, 1994; CIANCIO and NOCENTINI, 1994a, b, c, d, e), then forest preservation and conservation are rightfully two alternative forms of manage-

ment. In practice, operations are carried out in agreement with and according to the canons of *silviculture on natural bases*, the *main idea* of which distinctly differs from «naturalistic silviculture» in its technical, scientific, epistemological and ethical content (CIANCIO, 1981; CIANCIO and NOCENTINI, 1994b).

To paraphrase HUMBERTO R. MATURANA, one could assert that *all that is seen is seen by an observer*. Forest management is a phenomenon which is external and not internal to the system. And it belongs to the interaction between observer and the forest. This means that one must read and understand the needs of the forest and make *knowledge* about it available to the system. This is the conceptual approach that we mentioned above: an approach which in practice results in algorithmic action (CIANCIO *et al.*, 1981; CIANCIO and NOCENTINI, 1994c) and a bio-economic approach which highlights the link between forest systems and the three E's: ecology, economics and ethics.

8 – *Think like a forest*

Such a concept constitutes a subtle, but significant, change in outlook. It allows some controversial aspects of forest management, which have never been approached before, to be made plain. It allows us to make it quite clear that, as they are forms of forest management, «preservation» and «conservation» do not either theoretically or in practice exclude action in favour and in support of the forest. And, moreover, it defines the *bio-economy of forest systems* as the sum of the multiple relationships which are established between ecology, economics, ethics and the environment.

All this represents a substantial and original innovation. On one hand, it outlines new ways in perceiving the forest.

On the other, it constitutes the base for a scientific debate on topics which have not previously been taken into due consideration or which have even been disregarded. Furthermore, here is the chance to define a research strategy with unpredictable future developments.

If the afore-mentioned bio-economic concept is accepted and there is a desire for coherence, then we must «*think like a forest*». In practice this means thinking in a completely different way from the present one. We must no longer look on the forest as a factory for producing wood or other commodities, but as a complex system where «disorder» is misunderstood «order». A system where health and wealth are measured by its bio-diversity.

It is necessary to enter into a different relationship with the forest: no longer to see it as an instrument to control from the outside, but as a system which has value in itself. A system with its *soul* being manifest in its uniqueness and, at the same time, in its multiplicity. This concept determines an alternative to the traditional course. It contributes to the body of thought and makes the highest use of the foresters' professional competence and skills.

REFERENCES

- CIANCIO O., 1981 – *I massimi sistemi in selvicoltura*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. XXX: 113-142.
- , 1987 – *Interventi selvicolturali nelle aree protette*. Atti del convegno «Parchi e riserve naturali nella gestione territoriale», Viterbo: 218-232.
- , 1988 – *Il bosco bene di interesse pubblico*. L'Italia Forestale e Montana, 43 (4): 267-270.
- , 1991 – *La Selvicoltura oggi*. L'Italia Forestale e Montana, 46 (1): 7-20.
- , 1992 – *La questione forestale italiana: l'orizzonte possibile*. L'Italia Forestale e Montana, 47 (6): 321-339.
- , 1994 – *Selvicoltura, assestamento, economia forestale... e altro*. L'Italia Forestale e Montana, 49 (3): 232-240.

- , 1994 – *L'arte della ricerca scientifica*. L'Italia Forestale e Montana, 49 (4): 333-335.
- , 1994 – *I diritti del bosco*. L'Italia Forestale e Montana, 49 (5): 445.
- CIANCIO O., IOVINO F., NOCENTINI S., 1994 – *La teoria del bosco normale*. L'Italia Forestale e Montana, 49 (5): 446-462.
- CIANCIO O., MERCURIO R., NOCENTINI S., 1981 – *Le specie forestali esotiche e le relazioni tra arboricoltura da legno e Selvicoltura*. Annali dell'Istituto Sperimentale per la Selvicoltura, Arezzo, Vol. XII: 1-103.
- CIANCIO O., NOCENTINI S., 1994a – *La gestione forestale nelle aree protette*. (in corso di pubblicazione).
- , 1994b – *Il metodo del controllo e la selvicoltura su basi naturali: un problema culturale e di gestione forestale*. L'Italia Forestale e Montana, 49 (4): 336-356.
- , 1994c – *Problemi e prospettive della gestione forestale*. L'Italia Forestale e Montana, 49 (6): 5 -5.
- , 1994d – *Il bosco: quale forma di gestione?* Linea ecologica, 26 (6): 10-13.
- , 1994e – *La foresta mediterranea: una nuova dimensione*. (in corso di pubblicazione).
- , 1995 – *Nuovi orientamenti in selvicoltura*. In: Giornata di studio sul «Global change», il verde per la difesa ed il ripristino dell'ambiente. 6ª giornata: il ruolo della selvicoltura per la difesa ed il ripristino dell'ambiente. I Georgofili. Atti dell'Accademia dei Georgofili, VII Serie, Vol. XLII: 11-23.
- DEL FAVERO R., 1990 – *Nuovi orientamenti nell'assestamento forestale*. Atti Corso di Aggiornamento Professionale Quadrifoglio Dolomiti, Belluno, 79-89.
- DIETRICH V., 1941 – *Forstliche Betriebswirtschaftslehre*. Bd. III, Erfolgsrechnung, Zielsetzung. Parey, Berlin et Hamburg, 310 p.
- PATRONE G., 1944. - *Lezioni di assestamento forestale*. Firenze.
- , 1972 – *Stravaganza prima: l'essenza dell'assestamento forestale*. L'Italia Forestale e Montana, 27 (1): 1-22.
- SCHÜTZ J. PH., 1989 – *Sylviculture 1. Principes d'éducation des forêts*. Presses polytechniques et universitaires romandes. Lausanne.
- , 1991 – *Tendances actuelles de la sylviculture en Europe occidentale*. Comptes rendus de l'Académie d'agriculture de France. Vol. 77 (8): 3-14.

Donato Romano

FROM THE FOREST
TO FOREST MANAGEMENT: A FEW
CONSIDERATIONS ON ECONOMICS

FROM THE FOREST TO FOREST MANAGEMENT: A FEW CONSIDERATIONS ON ECONOMICS

Introduction

Economics (and especially natural resources economics) developed with the aim of analysing issues emerging from the interaction between society and the environment (the latter in the broadest sense of natural and man-made environment). The different economic phenomena under observation may, of course, present peculiar characteristics depending on the subject and the facts involved and, therefore, each field of economics has its own methodology (tools of analysis, models, aims) which differentiate it from the others.

The purpose of this paper is to show how, starting from certain features of forest production, it is possible to obtain some specific results: (i) establishing the requirements for the economic analysis of forest production processes and (ii) drawing management directions from such requirements (i.e. type of silvicultural intervention and economic *locus* of the different forms of forestry), which can be considered applicable to the current situation in Italy.

Economic characteristics of forest production processes

Forest production processes have several features (Fig. 1),

some of which may also be found in other close-related production processes (e.g., a few types of agricultural production, such as fruit tree farming), whilst others are absolutely peculiar to forestry. Such features derive mostly from the biological character of forest production and from the considerable social meaning of forestry. It is from the interaction of these two levels of analysis (environmental and social) that some economic characteristics, which can be classified as primary or derivative, according to whether they represent primary determinants of forest production (technical characteristics) or ultimate ones (economic characteristics strictly speaking), are derived.

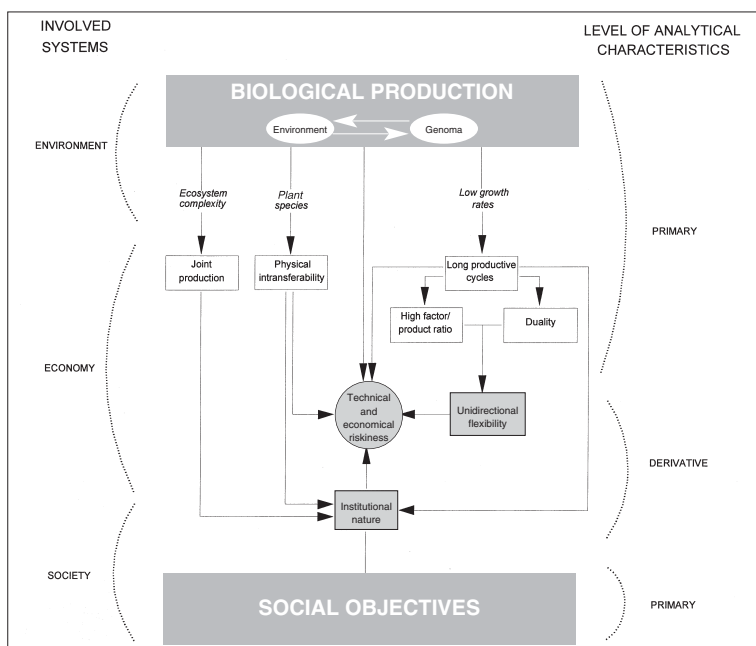


Fig. 1

Primary characteristics

Among the primary (technical) characteristics of forest production, we wish to mention:

- a) the fact that forest production processes are a typical example of *joint production* ⁽¹⁾ of material products (timber, berries, mushrooms, game) and immaterial products (outdoor recreation, soil protection, scenic beauties, air cleaning);
- b) the *physical intransferability* of forest stand, which obviously renders forest production different from other types of production, plant production excepted, as it is impossible to move the forest without losing its productive capacity ⁽²⁾;
- c) the *length of forest productive cycles* which implies a strengthening of the following characteristics of capital intensiveness and duality of forest production ⁽³⁾;
- d) the *high factor/product ratio* (stock/increment), which qualifies forest production as a highly capital intensive activity and, therefore, has considerable implications in terms of sectoral policy ⁽⁴⁾;

(1) In some cases, there is complementarity between the various products, whereas in others there is competitiveness. This brings about the need for management choices, onto which there can be grafted conflict on the part of various interest groups, usually holding interest only in a few forest products. Furthermore, this means that the network of economic relations which arise from forest resources is far more complex so that the direct and indirect implications that any sectorial (i.e. forest sector) policy may have on other sectors of the economic system and vice versa are even more puzzling.

(2) In economic terms, this means the practical impossibility of benefiting from practices of spatial arbitrage, that is to say, taking advantage of the differences between prices existing in various zones by moving the asset from the zone characterised by lower selling prices (or higher production costs) to zones where it may be sold at higher prices (lower costs).

(3) This has clear implications on the profitability of forest private investment, in the sense that, given an equal financial rate of return, one will prefer an investment in a sector more readily «liquid» than forestry.

(4) Not only are extremely long pay-back periods on invested capital necessary in forestry, but so are high capital investments.

- e) the «*dual*» *nature of the forest stand*, which is both «machine and product», so that it is not possible to harvest the forest yield without also «disinvesting» the plant that produced it ⁽⁵⁾.

Derivative characteristics

- a) the two immediately preceding characteristics determine a «*unidirectional flexibility of production*» in the sense that it is difficult to modify the quantity of product without investing for very long periods (on account of the low biological growth rates), while the product may be rapidly eliminated by simply felling the stand. This implicates a fundamental «asymmetry» in forestry decision-making ⁽⁶⁾;
- b) the *fundamentally institutional nature* of forestry, typical of all land production ⁽⁷⁾. Moreover, compared to agricultural production, the characteristics of joint production and long production processes lend strength to the institutional features of forest production: here is where norms (juridically codified rules) and conventions (traditional behavioural rules) come from. They are aimed at assuring in the

(5) It is true that such a characteristic is present in other cases of biological production as well (e.g. grain farming, floriculture, animal breeding, etc.), but it is self evident that the length of forest production cycles gives such a characteristic a very particular qualification.

(6) The possibility does fortunately exist that a lack of general flexibility is partially counterbalanced by a certain productive and temporal flexibility in forest production. Indeed, once the forest (i.e. lumber) has reached a reasonable size, it is possible to decide to steer production towards different products and/or to decide to wait to sell the products at the most advantageous moment, without risking any loss in production (at least within a certain lapse in time).

All the same, such considerations do not question the general validity of the assertion in the text with regard to an asymmetry in forest production decisions.

(7) It must be remembered that land is not only a productive factor, but it is also an asset of fundamental importance for the organisation of human society.

long run, control over a benefit stream deriving from actions which were carried out even several decades previously ⁽⁸⁾, or at guaranteeing the environmental sustainability of forest resources and the survival of the communities that depend on them ⁽⁹⁾;

- c) together these characteristics determine the *high degree of technical and economic risk* inherent in forest production. This degree of risk may come from environmental phenomena (such as a pest outbreak, the possibilities of wild fire or damages from abiotic agents, etc.) which are not at all or only slightly predictable), from market uncertainties (price dynamics and demand for forest products) and from uncertainties of institutional nature ⁽¹⁰⁾. In general, these risks and uncertainties end up by lowering the financial forest investment rate of return.

(8) Consider, for example, the communal property management regime of woodlands and pastures, much more widespread in the past, but which still today continue to survive in a few particular situations (see the Mediaeval management systems of the *Magnifiche Comunità* of Fiemme and Fassa in the Dolomites, the *Regole Cadorine* in the Veneto region, the agrarian universities in the Apennines, etc.). From the economic point of view, the «institutionalisation» of forest activities contributes to an increase in the level of the intertemporal efficiency of forest production.

As is well-known, institutions represent collective rules which define socially acceptable individual or group behaviour. That is to say, they are a set of conventions and norms that define the «working rules» of society. They emerge with the aim of diminishing the degree of uncertainty in the economic and social environment. In this sense, the examples given above are an alternative instrument to the market and to private ownership rights for reducing the intertemporal uncertainty of economic and social decisions.

(9) In this case, the reference is to the so-called «usi civici» (i.e. community uses of natural resources).

(10) Institutional uncertainties concern the variability of the institutional setting taken in a broad sense (norms which rule the enjoyment of owner rights, trends in forestry and environmental policy, objectives of society on the whole, etc.) between the moment when the decision to invest is taken and when the yield of such a decision is obtained (the recent example of Law N. 431/85 – the so-called legge Galasso – goes for all; in the brief period of a few months it protected practically all of Italy's forestland).

In conclusion, an economic theory of forest production must take into account that forest production is a process which is carried out in an «irreversible» way over time and, as such, must be able to grasp and analyse explicitly this fundamental dimension (i.e. time), according to an *evolutive approach*. Furthermore, regarding everything mentioned so far (combined production, length of production cycles, evolution of society's objectives), it is obvious that we cannot only take the «market» dimension of forest production into consideration, but we must refer to the entire group of economic, political, normative, social and cultural relationships and so on which characterise such a process. In a word, the analysis of forest production must, be an *institutionalist* analysis.

As will be seen, these characteristics play a crucial role both in explaining the attitude of various operators regarding forestry and in singling out the aims and instruments of forestry policy.

Implications for forest management and policies

From the above it is clear that the fulcrum around which forest production rotates, in a context similar to the one in Italy in particular, is the high degree of technical and economic risk. This has considerable implications from the management standpoint.

From a strictly financial standpoint (private point of view), it is possible to distinguish three fundamental strategies for reducing the risk in a given investment: diversifying investment, stipulating insurance contracts and gathering further information regarding possible choices and the respective outcomes. In the case of forest production, the practical impossibility of pursuing the last two options can be recog-

nised (given the lack of an insurance market for investments in the forest sector and the prohibitive cost of procuring information on a majority of uncertainty sources), while the diversification of forest investment is limited by risks and uncertainties characterising almost all investment in the sector. Therefore, in these conditions it seems reasonable that a risk averse person should consider forestry investment less appealing than other investment alternatives ⁽¹¹⁾.

These considerations are further reinforced if we move from a static perspective into a dynamic one. In this case, the processes of learning (which come about over time) gain in importance, in the sense that an observation of the results of actions undertaken in the preceding periods permits an increase in the amount of information available and, therefore, any errors can be corrected over the course of the sequence of periods which constitute the investment process. In other words, in situations characterised by uncertainty and irreversibility in the outcome of an action, a «preference for flexibility» in investment emerges. On account of the uncertainty regarding both tastes and future opportunities, people are willing to pay for options which allow them a wider range of choices in the future.

What has already been said has two important consequences at the operational level, determining a few priorities in silvicultural practice and the delimitation of the economic *locus* of different types of forestry.

From the point of view of forest management, it is obvious that rapid change in the social, economic and institution-

(11) In fact, the real value of forest investment for the private entrepreneur is not equal just to the expected value (hypothesising a perfect knowledge in conditions of certainty), but it is lowered by an amount equal to the so-called «risk premium», i.e. the quantity of money that a risk averse person would be willing to pay so as to avoid running into an undesired event.

al environment creates a disengagement between «forest time spans» and society's and the economy's time spans. In this situation, silvicultural practices which allow the maximisation of forest investment «flexibility» should be preferred and the slower the forest growth rate, the more important this becomes. In other words, even remembering that such general validity declarations must be verified in their application on a case by case basis, investments which allow an investment risk diversification (e.g. multiple-purpose forestry, agro-forestry, etc.) and/or the maintenance of a greater number of open options for the future (e.g. modular felling, cautious, comprehensive and continuous thinning) should be preferred to «rigid» investment. This is surely the case from a purely private point of view, but it is still valid in a public perspective (i.e., even when the objective is not immediate financial profitability, but proposes to accomplish certain social aims, *vide* the institutional nature in forest production).

From the point of view of the economic *locus* of forestry, it is evident that there are two different operational *loci*, private and public, which are quite clearly separated. From what has been stated above, there is little scope for private investments in forest production, unless there are very particular conditions guaranteeing high financial returns (e.g. fast growing plots for wood production, management of wildlife or game estates, etc.). The direct involvement of private entrepreneurs in the field of silviculture seems more unlikely, even in intermediate situations where there is no true silviculture, such as productive afforestation.

With that being the case, possible economic loci for private silviculture in Italy appear to be:

- a) lands marginal to agriculture, on which the revenues from annual crops and grazing turn out to be, if anything, extremely low, but which, despite everything, present a sufficient degree of fertility so that they are suitable for

productive forestry. Recent developments in the CAP (Common Agricultural Policy) permit wider income margins compared to the past, as well as expanding the range of species available to the entrepreneur, thus increasing the scope of environmental situations where forestry can take place ⁽¹²⁾;

- b) mountainous and hilly lands on which agricultural crops able to generate appreciable annual income can still be managed. The activity of productive silviculture, based on exotic, rapidly-growing species and on a few high-value broadleaves will probably be possible in those districts where farms can be found undergoing disactivation and/or extensivation (part time, pluriactivity, etc.) and/or where the employment of labour, in any case, constitutes a constraint on a more rational use of resources.

Given the diversity in objectives pursued by the public operator, it can, on the other hand, be hypothesised that actions in the field of traditional silviculture are his due, i.e. the woodland where an immediate economic interest is not pre-eminent, but where the social value emerges as the first concern.

The action of Public Administration can still be expressed with extremely positive effects in another important field, the creation of more favourable economic, social and institutional environments for the action of private entrepreneurs in the forestry sector. It should be stressed, however, that the pursuit of social aims as a by-product of private investments cannot come about unless the dirigist bureaucratic habit of forest administration is abandoned. If in the past it had reason to exist, in many situations it seems quite anachronistic, apart from being counterproductive.

(12) Forest investment is, in this way, less risky, given the possibility of using the most suitable species for each land class.

It is, however, sure that this new approach requires new relationships between the public and the private spheres which is certainly «higher» if compared to what we in Italy, have long been accustomed to. Public Authorities are thus compelled to maintain a more careful and far-reaching presence, with the aim of recuperating a role of institutional credibility, both in positive (the promotion of enterprise) and negative terms (enforcement of laws and norms), which has as its philosophy, rather than the imposition of ordinances and duties, the logic of involving private entrepreneurs.

Luigi Hermanin

CONSIDERATIONS
ON THE POLITICAL COMPONENT
OF THE FOREST REALITY IN ITALY

CONSIDERATIONS ON THE POLITICAL COMPONENT OF THE FOREST REALITY IN ITALY

In the broadest sense of the term, «reality» is synonymous with *all that which exists*. Both material and relational realities come under this very ample category.

Forest reality consists of both the physical reality, comprising the set of woodland formations differentiated in extension and shape, which constitute a complex whole, and the relational components: the silvicultural, economic and cultural realities.

The brief considerations set forth here are confined to the Italian forest reality, which is characterised by a great variation in the shape, composition and structure, and in the aggregation of formations that comprise the Italian forest landscape. It is an articulated and fragmented landscape the extremes of which are represented, on one side, by the larch forests and dwarf pine stands in the high Alpine valleys and, on the other, by Aleppo pine and dwarf palm in coastal forest formations in the South.

A similar situation, characterised by marked diversity, can be noted in the cultural, economic and politico-administrative aspects, although a unitary and centralised forest policy was implemented for over a hundred years, following the unification of Italy. The main objective of that policy was soil conservation and watershed reclamation (Forestry law of 1877); this course of action was confirmed and reorganised in the fundamental text of 1923.

A first fragmentation of the forestry policy stemmed from the full accomplishment of administrative autonomy, provided for by the Constitution, first at the regional level and later at the provincial level.

Inspired by the Constitution itself (which, in art. 44, refers to the need for «action in favour of mountain zones»), are the measures which aim at encouraging job creation in mountain areas by promoting soil conservation and watershed reclamation: the institutive law of the *Cassa per il Mezzogiorno* (Fund for the Development of Southern Italy), 1950 and the special law for mountain areas, 1952.

Two measures enacted in 1977 (Special Project n. 24, «Quadrifoglio») represent a change in direction with greater attention being paid to forest productivity.

The decree which transferred the responsibility for various sectors (among them, agriculture and forestry) from the State to Regional authorities was issued in the same year.

Since 1977, the central government has the task of deciding the main lines and co-ordinating regional forestry policies within the sphere of an outline law. Forest police activity and co-ordination in fire fighting are the duties of the State Forest Service.

In actual fact, starting from that date, a period has begun in the relations between the central and regional governments which, though it would be an exaggeration to define as conflictual, has been, at least on the part of the Ministry of Agriculture and Forests, one of passive resistance to the recognition of regional jurisdiction. This position was justified and supported by a situation that found many regional authorities inadequately prepared for their role. In fact, several of them have eluded the responsibilities ensuing from the new tasks, entrusting the State Forest Service with the role of making up for the lack of offices and personnel. This goes for ranger districts which have become regional offices where the staff

is employed by the Ministry of Agriculture and Forestry, and therefore depends on the co-ordination of the State Forest Service.

Over the course of time and in different ways depending on the various regions, the police function (both in forest and environmental matters) of the State Forest Service has gradually begun to get the upper hand over technical tasks which do, however, continue in some of the regions.

The outcome is that the different regional forest policies have different problems and outlooks. It is sad to admit that, in most central and southern regions in Italy, the administration of the forestry sector has never been prompted by a policy aspiring to development, but has simply complied with the sluggishness which has characterised the lack of stimulating action from the central government. More recently, the complete incapability to assimilate European regulations concerning land management and to put them into practice has been revealed.

On the other hand, a careful forest management policy has been observed in the whole of the north-eastern territory, in that area historically defined as the Three Venetias. This derives from the tradition of exploiting the forest as a resource and as a means of protection which is activated through efficient regional or provincial Forest services. In this area, the forest has benefited from a policy of investment which has brought all forests of public property and even a fair share of privately-owned ones under management, as well as providing a well-developed network of efficient forest roads, assistance to municipalities in the administration of forest resources and the training of technical and supervisory personnel.

In the repeated revisions of management plans, the unitary allowable cut has been maintained well below the increment, in this way allowing the progressive accumulation of grow-

ing stock. Consequently (as demonstrated by the national forest inventory), the greatest growing stock values per hectare in the country are attained in the north-east.

The accurate silvicultural management of the regulated forests is based on operations that are periodic and scattered through the area. This is possible thanks to an excellent forest road network. This type of management represents an advanced model not only for Italy. The concrete action of the forester finds strength and motivation in the knowledgeable use of the instruments that silviculture offers him, so that he is able to attain the pre-established goals.

This positive forest reality, which certainly can leave room for further improvement, casts credit on the district authorities and the administrative bodies responsible for it. It also reflects on the image of Italian forestry which, on account of these aspects, emerges (perhaps undeservedly so) as one of the leaders in the world panorama with regard to forest management within limits of sustainability and compatibility with the temporal continuity of the forest.

It is precisely on this base that it would seem appropriate that everyone – first and foremost the foresters and then the entire public opinion – should be aware that, in this sector at least, our country is able to export know-how, or rather a forest culture, based on a methodology of approach to problems, as well as technicians, trained in the management not of plantations, but of the complex forest systems in developing countries. In a nutshell, it should be pondered whether this is not the right model to satisfy both the need not to mortify timber production completely in the name of integral conservation and, at the same time, not to excessively simplify management by replacing the forest with tree farms.

In any case, we cannot help pointing out that a high degree of coherence in forest policies is tied to a high level of efficiency in the public administration. From this stand-

point, it is significant that the Regions which can be considered exemplary for their forest policy are the same ones where the economy is strongest, the public offices guarantee the services they are assigned and district health services function with an efficiency that is unheard of elsewhere.

In conclusion, it seems that a definite swing in national forest policy is possible only if there is both a high technical and cultural level, along with definite progress in the efficiency of the public administration.

The duty of the national government remains that of co-ordinating regional forest policies. By following a policy which is diametrically opposed to the existing one and in the light of the country's evolution towards federalism, such co-ordination should, on the one hand, stimulate the development of an independent government in the forestry sector in each Region, and on the other promote the comparison and diffusion of the results obtained at the regional level.

A specific division of the Ministry of Agriculture and Forests (which, according to the new denomination, would be assigned essentially to co-ordination within the European Union) should be dedicated to this task.

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THE SCIENTIFIC PARADIGM,
«GOOD SILVICULTURE»
AND THE WISDOM OF THE FORESTER

The authors have contributed equally to this paper.

THE SCIENTIFIC PARADIGM,
«GOOD SILVICULTURE»
AND THE WISDOM OF THE FORESTER

*Nature is a catalogue of monstrosities
which tend to conserve and reproduce themselves:
Man can be considered as an error of Nature
because he will succeed in destroying it, along with himself.*

Ennio Flaiano

1 – *The scientific revolution*

The pronouncement of a theory never happens by chance. It presupposes a critical analysis of the scientific paradigm of reference. What until a short time ago seemed clear, possessing an absolute precise logic, no longer responds to the needs of *scientific explanation*. The paradigm of reference shows its limits. All of a sudden, we realise that problems cannot be resolved within the reaches of codified knowledge. Change is in things. It is becoming inexorable. A new scientific framework arises, develops and takes shape. The mutation implicates a different theoretical approach and a new paradigm of reference.

So it is, for example, that in the twenties, when it was not possible to use Newtonian logic to resolve some of the problems of atomic structure in physics, the scientific paradigm began its mutation. In forestry sciences, the solution to problems connected to forest management using the old framework (centred on the mechanistic outlook and the reductionistic method) is now considered inadequate and out-dated. Limits have emerged with the growth of knowledge in

Modern physics was born with Galileo who founded mechanics without considering friction, in spite of the fact that in everyday life friction is crucial (try to imagine the world without friction!). An object that is not subject to forces and that moves with uniform, rectilinear motion (as in Newton's First law) is a pure abstraction and (not considering billiard balls) nothing that behaves this way has ever been seen on the face of the Earth.

Physics was born with a step backwards, refusing to comprehend reality on the whole and proposing to study only a small, in the beginning really tiny, corner of nature. Physicists were fully aware of the fact that they were studying an idealised, simplified world; Evangelista Torricelli, at the beginning of one of his treatises, wrote: «I pretend and suppose that some bodies move upward following the well known proportion and horizontally with equitable motion [...] if then balls made out of lead, iron, stone do not follow this supposed direction, too bad for them: we will say that we are not speaking about them».

This step backwards, this breaking away from the tradition of trying to understand reality in its wholeness, has allowed physics to conquer solid ground, a stable basis on which to build the following structures. (G. PARISI, 1994).

In NEWTONIAN PHYSICS:

prediction has a *strong meaning* but a *narrow range of application*; the language is mathematical and is expressed by a *linear system* of differential equations;

in COMPLEX SYSTEM PHYSICS:

prediction has a *weak meaning* but a *wide range of application*; the language still hasn't been codified.

It is a *non linear system* because the system can behave in different ways: many components interact and are subject to contrasting forces.

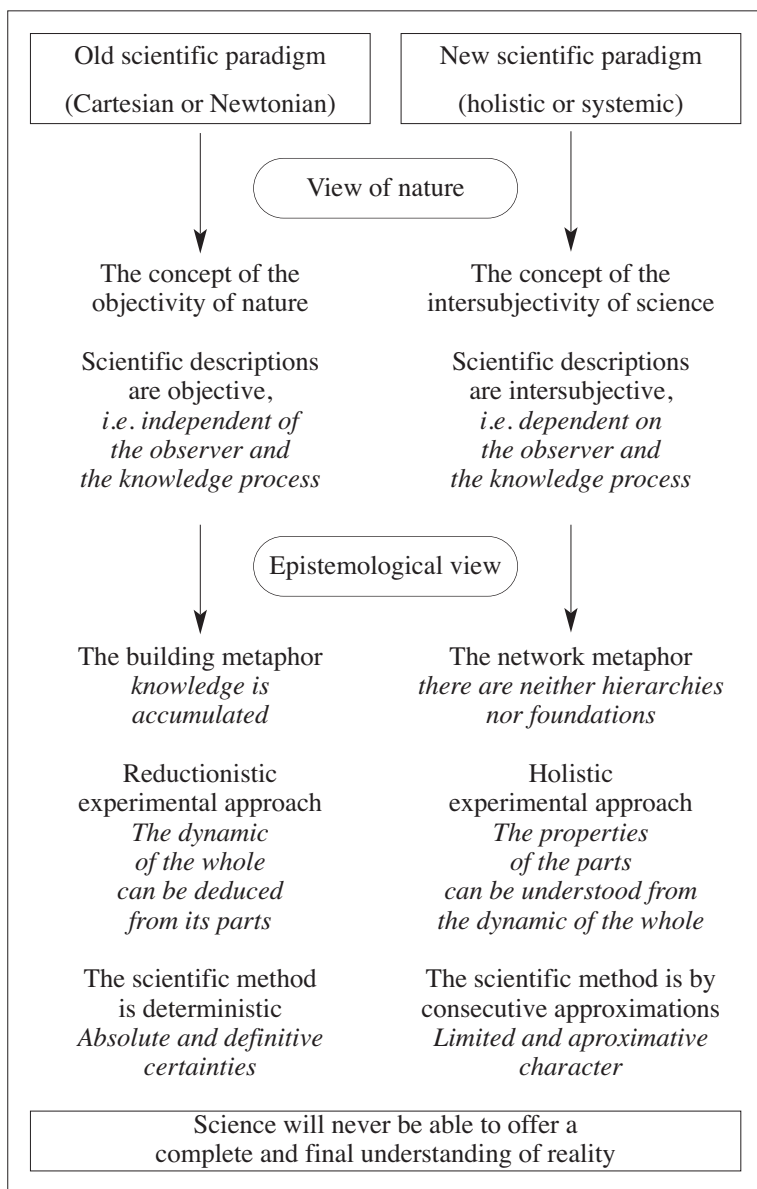
applied ecology, with the assertion of systemic thought, with the recognition of new values regarding the forest, etc. But this awareness is not yet linked to a theory capable of providing an adequate explanation of the new forestry dimension.

However, in order to avoid any misunderstanding, it will be just as well to clarify the fact that change in the scientific paradigm does not mean the epicede of the cognitive and technical apparatus of the past. No rejection of traditional methods is implied, but a quid is added which overturns the theoretical approach on which forest management is based. In short, we are dealing with a real scientific revolution, in the meaning that THOMAS KUHN gives to this expression. The proposition of a new research strategy necessarily involves analysing the past so as to interpret the present and to build the future. To this regard, we consider it of use to state some considerations which could help in giving a plausible explanation not only of the new way of seeing the forest, but also of the new way of looking at it.

2 – *The scientific paradigm and the building metaphor*

The scientific paradigm, also identified as Cartesian or Newtonian, is based on the concept of the objectivity of science. Descriptions are considered scientific if they are independent of the observer and of the process of knowledge. In short, according to this outlook, knowledge is built up indefinitely, step by step, in the supposition that definitive certainties will be reached. In the scientific field, the metaphor whereby knowledge is represented as a building, with its foundations, base bricks, etc. has dominated for some time. The attitude towards the *object* of study – the forest in this case – is one of domination and control.

Knowledge in the field of forestry was defined and



accepted by the scientific community on the basis of concepts, principles, theories, propositions and techniques which refer to this paradigm and link up with it. Paradoxically, the accumulation of knowledge came about in the framework of a physicalistic and deterministic outlook. The experimental approach was that of reductionism. The breaking up into parts and sections represented a working method. Research and experimentation were based on the conviction that, in a complex system, overall conduct could be deduced from the behaviour of single components.

3 – *The forest as a resource*

In the Mediterranean region the forest paid the consequences of precarious economic and social conditions by disappearing or by serious degradation. Under the thrust of events, action in reforestation and forest reclamation began in Italy at the beginning of the century. But only in the last fifty years has this process been accelerated.

Forest policy was centred on the increase of the forest surface on one side and on the other on silviculture, understood as the cultivation of natural and artificial forests. In the first case, «pioneer» and exotic forest species were used, a step which was considered compulsory for the rapid attainment of the pre-fixed goals. In the second case, the limit in wood cutting was considered an allowable cut lower, or at the most equal, to the natural increment of each stand. Consequently, forest planning was subject to both the postulate of cultivation continuity and the logic of favouring the needs of the owner. This compromise still lies at the base of a management project built up through study, research and experimentation over the years.

But did these principles find true assent? In practice, were

these programmatic lines taken into account? The answer is complex; certainly not unambiguous. It may be said that programmes were globally respected. Locally, on the contrary, action veered off those lines either in a partial and barely evident way, or totally and macroscopically. In any case, timber felling was the result of precise technical choices and related to predetermined solutions. In short, the aim was to trigger off a process which made the most of the forest's productive potentialities and the pursuit of positive financial returns was proposed.

Indeed, action was taken following a mediation from which the triple soul of the forester can be easily seen: the biological soul which projects itself into the search for the functionality of the system, fostering the process of regeneration; the engineering soul bound to the application of cultivation and felling techniques; and the economic soul which is summed up in cost/benefit analysis. In epistemological terms, this approach could refer back to an outlook that considers the forest a resource, a *heteronomous* entity which, precisely because of its existence, must be subject to control, a natural *object* to be bent to the needs and desires of man.

4 – *The new scientific paradigm and the network metaphor*

The new scientific paradigm is based on the concept of the intersubjectivity of science. The descriptions refer to natural phenomena. The metaphor of knowledge is that of the network of relations. The knowledge process is based on the systemic outlook. The experimental approach is holistic. The method of *trial and elimination of errors*, i.e. by successive approximations, is followed.

A position which looks at the forest as a complex biologi-

cal system has made way over these last few years. That is to say, it is a system which enjoys the property of *autonomy*. It is capable of subordinating structural changes to the conservation of its own *organisation*. The components of the system constitute an interconnected relational network. The properties of the whole cannot be deduced from those of the parts. Even though it may seem paradoxical, with the new scientific paradigm it is not so much the practical approach which is under discussion but the theoretical approach. A difficult step which presupposes a different outlook and a new cultural dimension.

In order to identify and define *silviculture on natural bases*, the theoretical assumptions at the base of forest management were examined in previous essays ⁽¹⁾. However, this does not always transpire in new modes of cultivation. The differences in this sense are at times irrelevant. Classical cultivation techniques are often applied in a more discreet and purposeful way. What does change, however, is the mental process that leads to a different type of approach: the forest is considered a system and action is undertaken exclusively in its favour.

This is an approach which has the characteristic of presenting what, in the scientific field, is defined as *internal coherence*. This is not a compromise with established knowledge, as may appear on a summary inspection. The evolution of thought leads to a new dimension: *the culture of the forest culture*. Moreover, the awareness that action is taken according to a different, more complex theoretical dimension confers dignity on work in the forest; it represents a different man-forest relationship and imparts authenticity to the forestry profession.

(1) CIANCIO, 1991, 1992, 1994; CIANCIO and NOCENTINI, 1994a, b, c, d, e; CIANCIO *et al.*, 1994; CIANCIO and NOCENTINI, 1995.

5 – *Good silviculture and the wisdom of the forester*

At the moment, foresters try to reduce the impact of cultivation operations, and exploitation of the system as much as possible. In the areas where bonds with the cultural dimension of the forest are strongest, so-called «free silviculture» is often applied. This is silviculture which is detached from temporal and spatial ties and released from bonds such as rotation, maximum felling diameter and the allowable cut. This means a form of silviculture which paradoxically goes beyond forest planning and its predefined patterns: a real gap between practice and knowledge.

Even in forested areas which are not subjected to planning, the forester – if he is not under heavy external pressure – intervenes by taking the needs of the forest into account. In other words, his actions may or may not follow a precise technical plan, but his conduct with regard to cultivation is, in any case, always oriented in favour and in the interest of the forest. The forester thus follows his intuition. Experience enables him to operate synthetically, bearing in mind the whole, as well as the different parts. The most plau-

Old scientific paradigm (Cartesian or Newtonian)	New scientific paradigm (holistic or systemic)
Framework <i>rational</i> <i>analytical</i> <i>reductionistic</i> <i>linear</i>	Framework <i>intuitive</i> <i>synthetic</i> <i>holistic</i> <i>non-linear</i>

sible interpretation of this is that the forester is aware of the need for a new approach to the forest.

His action still remains, however, anchored to the old theoretical framework. This framework has a logic based on a *rational, analytical, reductionistic and linear* way of thinking. A true contradiction between theory and practice that leads to a certain unease in practical, applied activity and which is manifested in the lack of confidence in his own convictions. But this sense of unease is symptomatic. It represents a change in the way of thinking that, in contrast, becomes *intuitive, synthetic, holistic and non-linear*. The metaphor of the semi-permeable membrane is useful in understanding how knowledge comes about. The scientific paradigm influences practice and this, in turn, is reflected in forestry thought. When this process will be codified, then practice will be coherent with the theoretical framework of reference.

Whoever lives in close contact with nature develops the conviction that the forest system is an entity with a value of its own. In his practical approach to the forest, the forester demonstrates that he shares in what is new. He «reads» the forest appropriately, he understands its needs and he acts accordingly. This is how, despite the inadequacy of the traditional scientific paradigm, he carries out «good silviculture». This transition may appear irrelevant to many, but it is a tangible sign that the old theoretical, scientific framework has become outdated and that there is a shift towards the new. But there is more. It represents *the wisdom of the forester*, wisdom which is perceived as the unity between science and ethics.

REFERENCES

- CIANCIO O., 1991 – *La Selvicoltura oggi*. L'Italia Forestale e Montana, 46 (1): 7-20.

- , 1992 – *La questione forestale italiana: l'orizzonte possibile*. L'Italia Forestale e Montana, 47 (6): 321-339.
- , 1994 – *Selvicoltura, assestamento, economia forestale... e altro*. L'Italia Forestale e Montana, 49 (3): 232-240.
- , 1994 – *L'arte della ricerca scientifica*. L'Italia Forestale e Montana, 49 (4): 333-335.
- CIANCIO O., IOVINO F., NOCENTINI S., 1994 – *La teoria del bosco normale*. L'Italia Forestale e Montana, 49 (5): 446-462.
- CIANCIO O., NOCENTINI S., 1994a – *La gestione forestale nelle aree protette*. Linea ecologica, 26 (6): 10-13.
- , 1994b – *Il metodo del controllo e la selvicoltura su basi naturali: un problema culturale e di gestione forestale*. L'Italia Forestale e Montana, 49 (4): 336-356.
- , 1994c – *Problemi e prospettive della gestione forestale*. L'Italia Forestale e Montana, 49 (6): 550 -566.
- , 1994d – *Il bosco: quale forma di gestione?* (in corso di pubblicazione).
- , 1994e – *La foresta mediterranea: una nuova dimensione*. (in corso di pubblicazione).
- , 1995 – *Nuovi orientamenti in selvicoltura*. In: Giornate di studio sul «Global change», il verde per la difesa ed il ripristino dell'ambiente. 6ª giornata: il ruolo della selvicoltura per la difesa ed il ripristino dell'ambiente. I Georgofili. Atti dell'Accademia dei Georgofili, VII Serie, Vol. XLII: 11-23.
- PARISI G., 1994 – *La complessità in fisica*. In: Il nuovo volto dell'univers. A cura di COTTA S. e RADICATI DI BROZOLO L.A., Biblioteca di cultura moderna, Laterza.

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A NEW DIMENSION
OF THE MEDITERRANEAN FOREST
FOR THE PREVENTION OF FOREST FIRES

The authors have contributed equally to this paper.

A NEW DIMENSION OF THE MEDITERRANEAN FOREST FOR THE PREVENTION OF FOREST FIRES

*I believe in the real likelihood
of a world where,
even though Man has little,
he can be a lot.*

Erich Fromm

1 – *The new barbarians*

In the Mediterranean region, fire has always been a determining factor in shaping vegetation. Man has used it to modify the natural environment in order to satisfy his own vital needs. The disappearance of large tracts of forest is due to this age-old cause which, unfortunately, still exists in certain areas.

The improvement in living conditions in Italy has led to changes in the use of the forest which, to tell the truth, is better safeguarded today on both the technical and juridical levels. Nonetheless, the problem of forest fires has recently become so serious that it has reached pathological and catastrophic proportions, despite the constant increase in investment directed at preventing and controlling the phenomenon.

The news of havoc wreaked by fires is reported by the *media* with great emphasis. Forest destruction provokes great dismay. This is because the poor and degraded forest (though indeed it is also distinctive and significant) is an integral,

vital part of the Mediterranean context. It is difficult to imagine living and working in a different context. There is also a contradiction between the confidence ensuing from the use of the ample means available and the fear of impotence when faced with these events. And the awareness of the effort which is put into trying to avoid or reduce the effects does not diminish the distress and anguish.

Today as yesterday – or rather today *more* than yesterday (if the technical and operative aspects are excluded) – much discussion goes on concerning the cultural issue connected to the prevention of forest fires, but little is done. The heart of the problem is not probed. The fact that the more perverse and hazardous upset is due not to the failure of technology but to its success is forgotten or not adequately considered. The consequences are often transformed into true boomerangs. In this sense, JOSÈ ORTEGA Y GASSET defines as the «*new barbarians*» those who take advantage of modernity without worrying about the consequences. If there is consent on this barbaric modernism then we will have to be ready to pay the price. It will, unfortunately, be a high price. Indeed, an especially high one: the forest is burning. And sooner or later it will vanish.

2 – *Fire prevention on a technical level*

On a technical level, fire prevention has given satisfactory results (locally, at least) and can still do so. Effective systems of prevention and control have been studied and set up in the research and operational spheres. Prevention, which many hold to be the most efficacious weapon, is generally based on several actions.

The first is the analysis of the ecological features of the forest and on the definition of the most suitable cultivation

methods with which to reduce the fire hazard to a minimum. The second concerns the infrastructures that must be available on the area to be protected. The third involves organising look-out towers and the use of automatic systems. The fourth entails stimulating public interest in the problem through information.

But however useful these actions are, they hardly ever have much effect on reducing the phenomenon. Statistics over recent years have demonstrated this. The reason is that fire control is a complex problem, difficult to resolve. It lies on issues of a political, social and economic nature. (CIANCIO, 1994).

3 – The cultural dimension as fire prevention

Trying to find a technical solution to a problem of a general order such as that of forest fires means relying on simplification. The forest is a system which does not interact with the physical environment alone, but also with man and society and therefore with culture. Against forest fires we must act locally, but we must think globally. Otherwise we end up proposing, with slight adjustment, what is already known: what has already been codified is transcribed and repeated. If this were indeed the case, culture and progress would be denied. The natural thrust towards new cognitive horizons would be nullified. The problem would be reduced to pure nonsense.

In order to face the question of fire prevention effectively, above all else we must also enter the sphere belonging to thought and therefore to culture. The outlook is thus wider. Interests become theoretical and distant rather than practical and immediate. It is necessary to tread new paths (with the consequences of a theoretical and practical order) to prevent

fires and safeguard the forest. One of these paths is represented by the assumption that the forest is a *subject of rights*. That is to say, an *entity of value* and not an *instrumental entity*. The other path, parallel and complementary to the first, is based on the theorem that the forest is a system (CIANCIO, 1991, 1994; CIANCIO and NOCENTINI, 1994).

The forest has a dimension of its own. It is an axiological category. Accordingly, man must behave with respect and love towards it. To respond adequately to the serious problem of fire, the main road is the cultural dimension of the forest. The issue is of fundamental importance. It touches the roots of a way of conceiving and interpreting man's «contact» with the forest.

4 – Scientific and cultural formation

A new way of perceiving the forest could only come fully into its own if we go beyond the technocratic and productive model that the forestry world (whether Italian or otherwise) still considers the most suitable for conserving or reviving the efficiency of the forest and defending it from the hazard of fire.

For this to happen, some conditions must subsist. The first concerns the scientific paradigm which has been adopted until now. To correctly interpret natural phenomena connected with the forest and the interrelationship with the environment and society, it is necessary to change the paradigm of reference: from an analytic, reductionist and linear paradigm we must shift towards an intuitive, synthetic, holistic and non-linear one (CIANCIO and NOCENTINI, 1995).

The second condition concerns scientific and cultural training: a crucial moment for understanding the significance of the problem. The cognitive process cannot and must not

remain locked in a stronghold to which only the few elect have access to. It must take place within the wider sphere of culture.

Training at university level as it is today is a necessary but insufficient condition for facing up to the forest fire issue properly. Not only must technical notions be handed on to youth, but also skills of critical analysis. That is to say, we must make sure that they are prepared not only technically, but culturally as well. Or, if you wish, we must promote the transition from excessive technicality to a technical, scientific culture. In short, young people must be fully aware of the forest's meaning and value. Only in this way will a solution be found to many present-day problems.

5 – Forest functions

The Mediterranean peoples have fought long, harsh battles against trees and forests, obtaining victories which were short-lived when considering the disastrous effects that have had to be suffered and endured in the long term. Modifications to the forest brought about not only by fires, but also by transformations due to cultivation, grazing and irrational exploitation, have provoked lacerations which are not easily healed.

Vast surfaces have been laid bare and impoverished. Widespread, serious erosive phenomena constitute a hazard. Forest degradation is a fact of huge consequence. Desertification is a real problem. There is also instability in the environmental system which is not easy to wage battle on. The tree death rate due to pollution and meteorological and biotic events bodes ill for the health of a part of the forest. The increase in fires is the border line of a very deep crisis.

Over the last century, the forest was recognised as having

functions other than that of production. In an environment such as the Mediterranean which has uneven morphology, widespread soil and slope instability and a rainfall frequently of high or very high intensity, the function of soil protection and conservation has assumed priority ranking. A significant turning point was reached with the rapid social and economic development which Italy enjoyed in the sixties. It was appreciated that the forest not only performs these tasks, but also services linked with recreation and landscape enhancement; in short, the so-called third dimension of the forest (SUSMEL, 1968).

6 – Ecological thinking

Over these last few years, moreover, there has been a deep change in the more advanced sectors of society. Recent acquisitions in the scientific field (markedly in the field of applied ecology) and awareness of the limits of a type of development which did not take into account the need to safeguard and respect the environment, have allowed a different relationship to be established between man and nature and, consequently, between man and the forest. Research has progressed from the study of trees as individuals to the study of the relationships between them, trying to interpret the true essence of the free, casual formation of organisations at various levels and their autonomous interaction with the environment.

The debate on ecological thinking has taken shape. It is structured in three currents. The first is defined as «anthropocentrism»; it is founded on the principle that natural objects have an instrumental value. The second is identified as «utilitarianism»; what is useful is beneficial. In the anthropocentric perspective, it represents the reformist current. The third,

known as *deep ecology*, as opposed to *shallow ecology*, represents a coherent doctrine of nature as a subject with rights.

This last current has become the dominant ideology of many alternative movements in North and Central Europe and in the United States and puts anthropocentrism newly under discussion: man belongs to the biosphere and represents one of the species in the ecosystem. Accordingly, he cannot be placed at the centre of the world. Clearly, we are witnessing a cultural revolution true and proper.

With regard to what more closely concerns the forest question, the idea of the forest as a *reserve* is gradually replacing the idea of the forest as a *resource*. Here we have a key contrast. An atomistic, materialistic, illuminist concept is highlighted on one side, while on the other, a holistic, idealistic, romantic concept is exalted. The response to one extreme is another, opposite extreme. The issue is, however, broader and more complex.

7 – *Disorder in the forest*

The current forest physiognomy is the outcome of the network of interrelationships that man weaves with the environment. The structure of the forest derives from the management and cultivation methods that have been developed with the intention of attaining maximum timber production and/or other utilities. In Italy, forest cultivation is still summarised in the widely dominant conception of so-called *regulated* silviculture in antithesis to what, with increasing vigour, is being proposed and generally put into action: so-called *free* silviculture (CIANCIO, 1992).

Present forest practice is based on a model of a linear type. In even-aged forests, thinnings are followed by regeneration felling which can determine a traumatic interruption

in the forest cover, and, at times, the sudden disappearance of tracts of forest. Moreover, these operations symbolise exploitation and are often the cause of rejection. In uneven-aged forests, however, selection felling has a lower impact on the environment. However, it is still a management model aimed at economic realism.

To improve the functionality of forest systems, the simplification of the structure and the regularity of and in the forest have been sought with assiduity. It is a perspective which, on the one hand, is pervaded by the perception of the forest as separate from the environment and its components as distinct and measurable; and on the other, by an outlook which implies the subjugation of nature to the will of man, who holds the right to direct and control it for his own purposes. Indeed a perspective that is the expression of Newtonian thought in the first case and of Cartesian in the second.

We must free ourselves from the usual «patterns» of order and regularity which beguile us that we can cage the forest in. Patterns which are based on the construction of a contrived and artificial order, in contrast to «natural disorder». We must realise that forest «disorder» or «chaos» is in actual fact misunderstood order.

The time has come not to think of the forest as a collection of trees, but as a system characterised by a structure with a high information content, capable of adapting to variations in external conditions and of evolving in ever different forms. When the forest burns, it is not only trees that die. Something else is lost. The organisation disintegrates and with this the biological functionality of the system.

8 – Forest management and fire prevention

Forest biocoenoses are constantly changing. Upheaval,

whether intrinsic or extrinsic, provokes structural modification. Phytocoenoses adapt to this, autonomously reviving new forms of equilibrium. In short, natural reality is not something static and unchangeable, but something inclined to continual, slow and constant development and change.

The complexity and length of biological cycles characterises forest systems. In such a wide temporal space, some events (avalanches, torrential floods, catastrophic winds and, above all, fires) alter the efficiency of the forest. They cause the destruction of stands over more or less vast areas. And they interfere with soil evolution and with microfauna activity.

Negative effects, however, occur following faulty or inappropriate management. A few examples? Hazard factors are constituted by the forms of treatment which simplify forest structure, excessive grazing (with the well-known effects on regeneration and on soil) and the high concentration of the tourist flow. So we may paraphrase FRIEDRICH DÜRRENMATT, and say that the content of silviculture only concerns silviculturists, but that the effects of silviculture concern everybody.

The examination of such hazard factors should guide man's actions in the forest and should have more weight in formulating the lines of management in forest systems. Besides, it should constitute an element of relevant importance for the long-awaited *return to nature*. This does not mean return to the origins which, as VALERIO GIACOMINI (1964) states, is not practicable in Italy, but rather the reconsideration of some technical exaggerations and the outlawing of certain types of behaviour with regard to the forest.

Forest management becomes a form of fire prevention on one condition: not to remove, but to introduce energy, work and capital. Choices as to the type and degree of management vary according to the environmental and human context. Cultivation operations should always be unfailingly in

the interests and favour of the forest. Its use, multiple and changeable in time and space, must safeguard, defend and build up the forest with wisdom.

Thus there is a need for silviculture to be increasingly oriented towards cultivation standards which are more suited to a complex reality such as the forest. This is not only because they are closer to natural forms, but because they offer the advantage of avoiding the creation of conditions which would offend the sensitivity of those who look on the forest with love and respect.

9 – Renaturalising today's forests

In order to cope with the serious condition of forest degradation, a strong impetus to enlarging the forest area was given immediately after the first World War. Afforestation initially had protective aims, later also productive ones. Indeed, since the middle of this century, forest activity has been characterised by the large scale use of fast growing species. Whatever the aims, simplified systems which were highly susceptible to fire were created in both cases.

Renaturalising the present cultivated forest is the road to be followed to foster greater overall efficiency and consequently higher fire resistance. The aim of renaturalisation is to promote stand evolution towards systems where relational organisation mechanisms among all the components (not just among trees) and between these and the physical environment, reach an elevated level.

In practice, specific silvicultural systems which pursue «regular» structures, whether they be even- or uneven-aged, are excluded. Instead, the aim is to intensify the functionality of ecosystems. Ascertaining the effects provoked by such action constitutes a constant commitment on the part of the

forester who, by «reading» the forest's reaction, may follow the evolutive process and back it up.

What we wish to emphasise here is the concept which lies at the base of renaturalisation: that is the exclusion of any *a priori* reference «model», while confidence is given to self-organisation, to the autopoiesis of the system. Renaturalisation of forest plantations tends to favour the reintroduction of autochthonous species, represented throughout most of Italy by broad-leaves which are well adapted to the environment and often also to repeated fires.

10 – The forest: a reference point for the future

To defend the forest from fire it must be not only be safeguarded but also respected. It must be approached by trying to understand its needs. The possible system could be cultivation based on cautious, continuous and capillary action – the three Cs of silviculture one could say – cultivation which is diversified according to each case, considering that each forest has its own individuality and is therefore different from all the others. Such a system determines a different approach to the forest.

But is it possible to think of a change in forest management that would consent the reduction of the fire scourge? Well, the cultural change necessary to give the forest the *status* of entity of value, of a public asset and no longer a *res nullius* which can be humiliated and offended, can come about accepting a new guiding idea: the forest as a *subject* and no longer an *object* (CIANCIO, 1991; 1994) as it is commonly considered.

The problems of the forest, and not only those relative to fire, can be resolved with the application of true, authentic silviculture on natural bases. That is, with the drafting, pro-

posal and realisation of an *open project* (CIANCIO, 1981; 1991; CIANCIO and NOCENTINI, 1994).

Until a short time ago, Italy was a country where people remained true to their habits. Now everybody has discovered the functions that the forest performs. There has been a change: interest in the forest has increased. But, at the same time, requests for services have grown dramatically. Consequently, the risks the forest is under and the damage it is subject to are increasing. Everybody has an idea of what the forest is, but not everybody knows that it is an essential reference point for making the present liveable and the future possible. Hence, it is a process of significant but disharmonious change. And the confusion is still greater if one adds the persistence of the old way of thinking, incompatible with modern use of natural resources. The need for the self-enforcement of restrictions springs from this condition. But as MAURO CERUTI asserts, restrictions are also opportunity. We must grasp the heuristic, ethical sense and meaning of this proposition and transcend them into cultural terms.

The position of the forest as an active, not passive, subject constitutes the presupposition for rethinking the problem in the awareness that knowledge multiplies non-knowledge. In practice, alternative paths are chosen which intersect learning connected to bio-diversity, to dishomogeneity and to the complexity of the forest.

11 – The culture of the forest

If the forest is able to provide clear, obvious elements, then foresters must refer to them. This means that the forest cannot be bent to man's wishes and desires (CIANCIO, 1991; 1992; CIANCIO and NOCENTINI, 1994a), though modern humanism

from DESCARTES onwards (whether deliberately or otherwise) has systematically ignored this aspect.

Reality must be treated by linking it to ideas, these in turn linked to technology, and then return to principles. Indeed, the essence of things is founded on principles. The over-evaluation of technology, the predominance of the technical aspect, all the rage in the forestry world, is quite clearly a mistake. Technology comes after principles and is certainly stronger and much more complete, but in the long run, research which drifts still further away from principles does not pay.

In order to draw up a new forestry project, we must abandon schematic methods which are as anachronistic as they are useless. It is not difficult to foresee that extremely refined forms of silviculture, aimed also at enhancing the aesthetic and cultural aspects of the forest entity, will prevail in the near future.

In conclusion, the tendency will be towards silviculture based on reading the forest and on applying *forest wisdom*. The cultivation act ought to be an expression of creativity and responsibility. Knowing how to read the biocoenosis and being able to understand the symptomatology it presents constitutes an element which leads, on the one hand, to the development of forestry science and the advancement of learning and, on the other, to an ideal man-forest relationship.

The present, cultivated forest is an expression of culture and, as such, finds a natural place in human experience. The forester must be able to decode its language so that he can then reassemble it in human language: i.e. act accordingly. The forest must be looked on with a sense of respect, which means with a sentiment that cannot be, as some maintain, the privilege of the forester alone because, on the contrary, it belongs to all and is the expression of the deep changes which have come about in the man-nature relationship.

This should be comprehensible and therefore acceptable to everyone whenever there is an awareness that self-respect and self-care presuppose and imply that man should respect and care for all other entities, whether biological or not. In this case, care and respect are aimed at guaranteeing the forest its functionality and continuity in time and space, while also (indeed especially so) defending it from fire.

Forest fires, nowadays, constitute the problem of all problems. Leading this situation back to internal reasons alone or merely to external social and technological changes is simplistic. The problem can only be resolved by acting in depth, by promoting culture. This is not easy. On the one side, clear ideas, logical rigour and coherence are inferred; on the other, the will to tread new paths is entailed. The forest is saved if the culture of fire prevention is upheld. It becomes the heritage of all; that is, if the forest is at the centre and not on the periphery of society's interests. To this end, the fostering of a «cultural maturity», which takes the forest into consideration as a value in itself is necessary. We must confer a new dimension on the forest: a cultural dimension. That is, *the culture of the forest*.

REFERENCES

- BOVIO G., 1995 – *Prevenzione*. Giornate di studio sul «Global change» - Il verde per la difesa ed il ripristino dell'ambiente. 6ª giornata: il ruolo della selvicoltura per la difesa ed il ripristino dell'ambiente. I Georgofili. Atti dell'Accademia dei Georgofili, VII Serie, Vol. XLII: 43-60.
- CIANCIO O., 1981 – *I massimi sistemi in selvicoltura*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. XXX: 113-142.
- , 1987 – *Interventi selvicolturali nelle aree protette*. Atti del convegno «Parchi e riserve naturali nella gestione territoriale», Viterbo: 218-232.
- , 1988 – *Il bosco bene di interesse pubblico*. L'Italia Forestale e Montana, 43 (4): 267-270.

- , 1991 – *La Selvicoltura oggi*. L'Italia Forestale e Montana, 46 (1): 7-20.
- , 1992 – *La questione forestale italiana: l'orizzonte possibile*. L'Italia Forestale e Montana, 47 (6): 321-339.
- , 1993 – *La ricerca scientifica e la formazione per lo sviluppo della selvicoltura e la tutela ambientale*. Gemellaggio Corso di Laurea in Scienze Forestali Palermo-Firenze, Bivona: 100-112.
- , 1993 – *Gli alberi e la città, il bosco e la montagna, simboli e metafore*. L'Italia Forestale e Montana, 48 (6): 384-390.
- , 1994 – *Selvicoltura, assestamento, economia forestale ... e altro*. L'Italia Forestale e Montana, 49 (3): 232-240.
- CIANCIO O., IOVINO F., NOCENTINI S., 1994 – *La teoria del bosco normale*. L'Italia Forestale e Montana, 49 (5): 446-462.
- CIANCIO O., NOCENTINI S., 1994 – *La gestione forestale nelle aree protette*. Linea ecologica, 26 (6): 10-13.
- , 1994a – *Il metodo del controllo e la selvicoltura su basi naturali: un problema culturale e di gestione forestale*. L'Italia Forestale e Montana, 49 (4): 336-356.
- , 1995 – *Il paradigma scientifico, la «buona selvicoltura» e la saggezza del forestale*. Il bosco e l'uomo. Accademia Italiana di Scienze Forestali, Firenze.
- GIACOMINI V., 1964 – *Equilibri biologici e produttività biologica delle foreste*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. XIII: 17-35.
- LEONE V., 1994 – *La difesa dagli incendi boschivi*. Giornate di studio sul «Global change» - Il verde per la difesa ed il ripristino dell'ambiente. 6ª giornata: il ruolo della selvicoltura per la difesa ed il ripristino dell'ambiente. I Georgofili. Atti dell'Accademia dei Georgofili, VII Serie, Vol. XLII: 11-23.
- PLAISANCE G., 1975 – *Qu'est-ce qu'une sylviculture d'incendie?* Revue forestière française, numéro spécial: *Les incendies de forêts*. Tome 2: 296-297.
- SUSMEL L., 1968 – *La terza dimensione della foresta*. Annali Accademia Italiana di Scienze Forestali, Firenze, Vol. XVII: 17-34.

Giovanni Bovio

EVOLUTION OF FIRE PREVENTION
AND THE RECONSTITUTION
OF DAMAGED FORESTS

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Introduction and aims

Protecting forests from fire is an issue which has developed recently in Italy. National or regional regulations (such as n. 47/75) make provision for fire control plans which, over the past few years, have evolved parallel to the techniques.

In addition to systems for fire prevention and extinguishment and for forest reconstitution which have been implemented along the way, studies which should ensure further progress are being conducted. Many improvements can be introduced both in the concept of planning itself and in cost control. Real progress will be made by correcting past errors and avoiding operations which have not proved useful.

In this paper, we wish to deal with the possible applications of some of the results from research. These could promote the co-ordination of fire prevention and the reconstitution of fire-damaged forests.

The considerations presented below are based on the conviction that, with no facile illusions, it is possible to improve what is already being done without negating any of the positive aspects there may be, while aiming for an overall protection of our forests from fire.

We have purposely avoided dealing with fire suppression, which, though an integral part of forest fire plans (Bovio, 1995), has too often been erroneously intended as the only solution.

Historical aspects

A historical analysis is important in order to understand in what way the forest today is more or less susceptible to fire.

Throughout the ages, man acted in the forest according to positive or negative values. Food, raw materials, defence, recreation and solitude were sought. The presence of dangerous animals and brigands was feared, difficulties in orientation and thoroughfare existed. For these reasons, the relationship with the forest has always been ambiguous (BERGIER, 1992).

In Europe in the late Middle Ages from 1000 to 1300, and particularly in Italy with the Communes after 1100, demographic and economic growth occurred with the expanding urbanisation. Although forests did remain virgin, a source of food, albeit feared, forests were eliminated to varying extents.

From 1500 to 1600, population growth halted, owing to a cooling in the climate. In all Western European countries (except in the North), there was famine. Despite limited technical progress, the forest remained hostile.

The demographic and economic situation picked up between 1700 and 1800 and the industrial revolution was heralded in. The natural sciences developed and the forest was studied, better understood and more widely used as a source of energy. Later on, the use of coal as fuel and iron in construction work slowed forest exploitation.

From 1800 to 1900, regulations were made to control the use and management of forests, while there was less demand for forest products than in the past. This laid the foundations of the care for the forest and of afforestation.

With the socio-economic evolution, there was a variation in the way the forest was approached and the situation of forest fires also changed. Documentation on this phenomenon goes back to the Middle Ages (AMOURIC, 1992).

Changes in silviculture and forest management have always induced variations in the forest landscape, directly effecting the causes which predispose forests to fire. Inflammable biomass has varied both in quantity and in spatial arrangement and distribution and the possibility of combustion has therefore been altered. Socio-economic conditions have also influenced decisive causes, which can almost exclusively be traced back to human attitudes, whether intentional or unintentional.

Regions under study

All of Italy is today touched by the fire phenomenon. A complete analysis for each administrative Region where the phenomenon assumes distinct connotations would only be possible considering the socio-economic conditions and all forest planning, in its strict relationship with general land management and planning.

As the considerations on the prevention and reconstitution that are to be introduced are appropriate where vast areas are concerned, we will dwell on a few Regions with larger surface area, analysing the progression of fires over the period from 1982-1991 with official data to hand (MRAAF, 1995).

The Regions under consideration are: Piedmont, Lombardy, Tuscany, Sardinia and Sicily. There is, among these regions, a relative homogeneity in the total surface area, while the amount of forest area is more variable. Except for Sardinia, the total area overrun by fire is also similar.

Contrariwise, the percentages of the total area overrun by fire register great differences with respect to the total forest area: Sardinia's is almost double when compared to Sicily and about eight times more than Tuscany.

Table 1

Region	Total area (ha)	Forest area* (ha)	N. of fires	Period 1982-1991			% area burned in relation to forest area	Mean area per fire (ha)
				Burned area (ha)		total		
				wooded	unwooded			
Piedmont	2.523.004	743.400	3.948	45.742	29.087	74.829	10,07	18,95
Lombardy	2.385.855	598.500	4.040	28.353	29.288	57.641	9,63	14,27
Tuscany	2.299.220	982.800	8.164	38.193	23.747	61.940	6,30	7,59
Sardinia	2.408.989	976.500	30.582	99.727	401.164	500.891	51,29	16,38
Sicily	2.570.723	266.400	2.539	38.342	40.097	78.439	29,44	30,89

* Source: MAF - ISAF (1988).

These data confirm that the greater risk falls in Italy's southern and insular areas (MANZARI and LEONE, 1990).

In Sicily, the mean area ravaged by each fire (for the years from 1982 to 1991) is double that in Sardinia, and four times that in Tuscany. In making a more thorough analysis, a great difference can easily be noted in the mean burned area per fire referred to the various months throughout the year. In Piedmont, for example, the highest mean area per fire event (in January) is equal to six times the lowest mean area (in July) in the period of observation 1980-1990 (BOVIO *et al.*, 1992).

This fact also obliges us to consider the period of the year when the events take place. Besides, it is opportune to bear in mind that the mean value is heavily influenced by the extremes of the distribution. As the extreme size values which describe the fires are very variable and the series are asymmetrical, it is absolutely necessary to back them up with a term better fitted to express the average value. A median line may suit this purpose.

The planner must consider small and large fires (the latter responsible for most of the area covered) as phenomena to be analysed separately (CAMIA, 1993) and the mean of which, offering a summary of the whole, can only be used for a few purposes. In order to define protective measures, we must therefore analyse the complete chain of events.

In the Italian reality, the number of small fires (burning a limited area) normally prevails. For example, in the cumulative distribution of the number of fires and the burned area with reference to Piedmont (from 1980 to 1990) and to Veneto (from 1981-1991), it turns out that 50% of the events are respectively under 1.1 ha and 3.1 ha (BOVIO and CAMIA, 1994). Furthermore, 90% of fires cover less than 30 ha and 10 ha respectively for Piedmont and Veneto (BOVIO and CAMIA, 1994 *op. cit.*).

In Sicily, as well, the above qualitative sequence holds true but episodic events regarding burned areas of considerable size make the situation worse. In this regard, can recall one episode in 1994: in the Commune of Cerda in the Province of Palermo (the municipality the most affected in all of Italy), 1020 ha were burned up (in two fires); in the Commune of Termini Imerese, 505 ha; and in the Commune of Monreale, 655 ha. At Caltagirone in the Province of Catania, 439 ha of forest area burned.

Recent evolution of plans for fire control

Over a large part of the land which is defended by fire control, the passage of fire is not desired and efforts are made to curb it with preventive and suppressive measures.

Nonetheless, the forest area which might conceivably be scourged by fire also acquires great importance (BOVIO, 1995 *op. cit.*). In this area the limits for the behaviour of the fire head are established and the conditions for controlling it are pursued. Each possible fire event is considered as the addend of a sum which corresponds to the total surface area that is established as can be effectively impacted by fire for a defined period.

In order to follow this approach, the acceptance of the criteria of «Fire Management» must be taken for granted (BOVIO, 1989), where the fact that the fire may pass over the area is not completely excluded.

According to the most recent evolution, each of the possible fires, up to the extent of the total surface area that may be covered, must also be a «tolerable fire», i.e. an expected event, which can be dealt with by the structure designated in the plan and it must not significantly nor permanently alter the entropy of the land. The features of a fire which is toler-

able, in terms both of extension and intensity, may vary depending on particular points of view. Indeed, in the interests of forest conservation, it must have no repercussions either on forest stability or on its sustainability. As far as the conservation of the landscape is concerned, it can only pass through the most resilient ecosystems.

Regarding the purely economical aspect, the sum of all the tolerable fires (corresponding to the surface area that they can be allowed to burn), will be the highest possible so as to limit extinguishing expenses. This economic outlook does not take into consideration damage caused by fires which are considered tolerable precisely because it is conceded that the area referred to may be burned.

The sum of all tolerable fires will, on the other hand, be the lowest possible for those who still share the concept of «Fire control» (Bovio, 1989, *op. cit.*) by which any fire must always be put out.

It can be noted that there are clashes at times and that the planner must therefore stoop to compromise. The plan directly determines the amount of prevention, which must be proportionate and suited to fire types. Furthermore, the procedures for implementation are varied and may come about through direct and indirect biomass control, producing conditions of resistance, slowing down dangerous winds or creating firebreaks. With intervention of this type being described in the relevant literature (Bovio, 1995 *op. cit.*), we will not dwell on the methods of application.

We wish, instead, to deal with the possibility of improving all preventive and forest reconstitution activity, referring to the territorial dimensions of the Regions which were mentioned above.

Prevention and reconstitution, as well as planning, must also be considered in the programming stage because of the importance that their temporal location assumes. In fact,

combustible biomass changes in time. Any intervention consequently has a varied effect. Finally, this activity must be present in viable projects which must respect planning aims.

The three stages of planning, programming and projecting are tied to scientific progress. Below, we will examine some sectors where there are current and potential chances of evolution.

Fire inventory

In order to draw up plans, and specifically to indicate the localisation of preventive measures, a knowledge of the places overrun by fire is necessary.

The currently used procedure for the fire surveys allows a considerable amount of data to be collected. Nonetheless, there are still gaps in our knowledge with regard to the damaging effects of fire; for instance, there has been no survey concerning the spontaneous reconstitution of vegetation. This lack of information creates difficulties in subdividing the territory into homogeneous areas.

There are methodological proposals for zoning the hazards (BOVIO and CAMIA, 1994 *op. cit.*) which can, however, merely indicate the priority of intervention, but they give little information as to the characteristics of prevention. Greater attention in surveying and mapping is, accordingly, the presupposition for knowing how to collocate and graduate prevention and reconstitution. Possible approaches are, however, very different, depending on the dimensions of the area.

We consider traditional methods (which resort to direct field surveying) to be valid over small areas, whilst they cannot be contemplated over vast ones because of the extremely high costs. Use of satellites is consequently the only answer as they offer greater possibilities at a lower cost. The results

of a study conducted on Brazilian territory is emblematic; an Advanced Very High Resolution Radiometer (AVHRR) on a NOAA satellite was used to map the area ravaged by fire. During the 1987 season, the affected area was estimated at 400 times what was indicated in the official statistics (SETZER and PEREIRA, 1991).

For some time now research in Italy, as well, has been carried out seeking to identify burned forest land with the aid of remote sensing by satellite (BOVIO *et al.*, 1990). We maintain that, for the dimensions of the administrative Regions mentioned above, a service can actually be hypothesised which may proceed to inventory fire events and geo-reference them. This structure could make use of a specific forestry information system. In any case, independently of the course of action undertaken, we are of the opinion that the objectives to be aimed at are the size of the ravaged area and the definition of the perimeter. This information should be supplemented with the indication of the forest species involved and the amount of damage suffered.

Fire hazard forecasting

Fire hazard forecasting is, today, an indispensable instrument for protection.

In various States, methods have been developed which respond to both territorial and organisational demands. Studies have recently been conducted to find out which method more closely meets the requirements of the various countries in the European Union (VIEGAS *et al.*, 1994).

The application of a fire hazard index on the regional scale, however, must be supported by experimental proof to demonstrate the reliability of the method in that particular environment. Furthermore, we believe the resort to automatic

instruments to be an appropriate measure both to limit errors and not to divert work forces.

The implementation of a fire hazard index is, today, lacking in many services. Its improvement needs further experimental investigation which must inevitably consider environmental characteristics through precise meteorological measuring effected on the ground.

A more sophisticated service may be hypothesised for organisations which must operate on the scale of the Regions mentioned above.

A very promising approach is the evaluation, by means of satellite radiometric responses, of the amount and seasonal evolution of the water stress in vegetation and the correlation of these values with the number of fire outbreaks. The NVDI (Normalised Vegetation Difference Index) may be used, which varies from -1 to $+1$ from soil without vegetation to complete tree cover, respectively. In any case, low values indicate low vegetative activity, corresponding to scarce water availability, whilst high values indicate intense vegetative activity with an abundance of water.

It is possible to glean information concerning the water stress of the forest from remote sensing by analysing multi-temporal series of vegetation indices. As an alternative, a reliable evaluation as to the quantity of water contained in tree crowns can be obtained by using radar data which have the advantage of being able to take measurements even through a layer of cloud.

These data may be used both for new forms of fire hazard forecast and for guiding direct prevention which is put into effect with preventive silviculture. Indeed, in the hypothesis of a service adopting remote sensing information, there can be an immediate answer as to the effective hazard level, and a consequent answer relating to the seasonal variation of the forest cover water content. These values, suitably stored in

files and averaged, can be extremely precious. Indeed, foreknowledge about fire conduct must be available in the planning stage of prevention in general and of silviculture in particular. This can be defined by simulations based on a known value of fuel humidity.

In managing biomass reduction (for example in the case of pruning or of green firebreaks), a knowledge of the average leaf humidity permits the definition of the conditions which favour the passage of ground fire to the crowns (MARTIN, 1988).

Forest reconstitution

Not even do the most organised services normally provide for the monitoring of fire-damaged vegetation. What is more, knowledge of the intensity of the fire head is often lacking. Consequently, it is not possible to place each fire event in the correct place in a fire intensity scale.

There are methodological proposals to evaluate fire behaviour on the basis of effects on the vegetation, which are evident even some time after the fire (BOVIO, 1994).

Information on the way in which vegetation recovers after a fire event may be gathered in the field. However, very high costs must be borne, because, at least theoretically, all places where the vegetation has been damaged should be checked. In actual fact, since that is only possible at great expense, this type of survey is completely ignored.

In most cases, especially in very resilient forest cover and after fires of low intensity, the cover reconstitutes itself spontaneously and in a short time. This happens to a greater extent in fires over limited areas (even though they might be intense), compared to those over vast areas; all conditions being equal, new individuals originate from lateral dissemi-

nation of the undamaged plants along the perimeter of the burned area.

There are, however, many situations where intervention is necessary for reconstitution. They often correspond to fires over greater areas which are likely to have a high and ruinous intensity because they exceed the modal value.

In the Italian Regions under consideration, we maintain that a fire exceeding 50 ha can be defined as large. This figure can obviously differ in other countries, varying with the environmental and organisational reality and, above all, with the attitude that society has towards the forest in that particular country.

All the same, independently of the threshold, a large fire can be followed by actual erosive processes. Furthermore, high rainfall is found during the autumn months in Mediterranean areas, towards the end of the period of greatest fire frequency.

There may be relevant perturbation on the equilibrium of fauna and negative influences on the landscape. If this is based chiefly on a visual criterion, the evaluation of the need for restorative action will not only depend on the damage suffered but, to a greater degree, on the place where it has occurred. Indeed, there may be areas where the importance of the landscape is outstanding and it may have different standing even among these areas.

So, the need for reconstitution will depend on the distance between the damaged zone and the observation point, on the aspect faced, in relation to the incidence of the sight line and on the type of cover (BOVIO, 1992).

In order to decide whether and where to carry out restorative intervention, information gathered from satellite images (concerning the aspects previously discussed) could be used.

There is a vast amount of literature on the application of remote sensing in estimating the evolution of vegetation

damaged by fire. The spatial, high-resolution sensors «Landsat Thematic Mapper» and «Spot-HVR» have been experimented with reference to Sardinian territory (BOVIO *et al.*, 1991).

It is for explicative ends that the distinction is made between remote sensing information regarding the fire inventory, direct prevention and recovery, and fire hazard forecasting. In practice, there should be one sole authority with powers both to plan and carry out actions, capable of guaranteeing all necessary knowledge for the collocation of intervention in time and space.

The concrete realisation of prevention and reconstitution imposes the use of Geographic Informative Systems (GIS), from which many applications have derived.

These informative systems are aimed at storing, processing and representing spatial information about the environment. They will accept data both in digital and analogue form, integrating the different variables and generating new informative levels from the original variables.

A GIS may be organised into both strata and objects. In the former case, strata are envisaged with a precise informative content. They may represent linear characteristics of the territory (hydrography, road networks, etc.) or surfaces (vegetation, management objectives, etc.). The number of strata defined to satisfy the demands of the user will be in relation to the obtainable information.

In the organisation into objects, the informative strata is substituted with a typology which the same objects belong to. An object may belong to a class because of certain characteristics, whereas for others it may, at the same time, be considered in another class. The set of objects in a class corresponds to the informative strata of the preceding set-up.

The capacity of the GIS used will depend on the mass of data and the desired processing.

Even quite complex information on the territory can be obtained with various configurations. For this reason, these instruments have frequently been employed for the realisation of fire hazard maps (CHUVIECO and CONGALDON, 1989) or maps of fire damage. Applications have also been built for the evolution of the fire-damaged vegetation or for the positioning of lookouts (PAWLINA *et al.*, 1990). In general, this instrument has been used for planning.

The connection of information to the geometry of the land and its characteristics, whether constant or variable in time, can offer a global vision which stems from a contextual examination of the sum of many items of information. The generation of derived information may also be obtained, up to the combination of the strata by means of expert systems (CAMIA, 1994).

Conclusions

The planning of forest fire control has evolved rapidly over the last few years. The traditional methods for organising prevention and reconstitution may today be flanked by methodologies which employ remote sensing information. Having the elements in appropriate places and moments for its realisation, prevention can be fully optimised with these instruments.

The same can be said for reconstitution, for which it is proposed to intervene on burnt areas of over 50 ha, where action is more important than on small areas. The evaluation of the damage and evolution of the vegetation will be the main informative concept regarding any possible intervention which, in any case, must be effected only if absolutely necessary.

In fact, just as in the case of the concepts of acceptable

fire size in view of limiting expenses, we believe that the natural capacities for reconstitution are to be exploited as far as possible. Furthermore, care must be taken that reconstitution does not clash with natural evolution and that the landscape is respected, particularly in environments dedicated to tourism.

The possibility of operating in a correct way today obliges us to gather and process masses of data in managing prevention and reconstitution; the use of GIS's becomes necessary as a result. All this is part of the continual evolution of actions in favour of forest fire control.

REFERENCES

- AMOURIC H., 1992 – *Le feu à l'épreuve du temps. Témoins et Arguments*. Narration. pp. 255.
- BERGIER J.F., 1992 – *La forêt devant les transformations de la société*. Planification forestière et environnement sociale. ETH. Ascona.
- BOVIO G., 1989 – *La pianificazione antincendi per la difesa del patrimonio boschivo*. Annali Accademia Italiana di Scienze Forestali, 38, 431-458.
- BOVIO G., 1992 – *Incendi, gestione forestale e paesaggio*. Atti del Corso di aggiornamento su: Gestione forestale, paesaggio, natura, ricreazione, 65-91. Università di Torino. Ormea.
- , 1994 – *Interpretazione del comportamento di incendi boschivi sulla base degli effetti*. Monti e Boschi. 1, 11-18.
- , 1995 – *Prevenzione*. Il ruolo della selvicoltura per la difesa ed il ripristino dell'ambiente. Accademia dei Georgofili. Firenze.
- BOVIO G., CAMIA A., NOSENZO A., 1992 – *Piano regionale per la difesa del patrimonio boschivo dagli incendi*. Regione Piemonte.
- BOVIO G., CAMIA A., 1994 – *Fire danger zoning using multivariate analysis*. Proc. 2° Int. Conf. Forest Fire Research. Vol. II, 733-745. Coimbra.
- BOVIO G., D'ANGELO M., BAGELLA S., CANU A., PODDA P., 1991 – *Applicazione di tecniche di telerilevamento per lo studio della ripresa della vegetazione in aree percorse da incendio*. Estratti convegno Monitorare l'Ambiente Agrario e Forestale. Accademia dei Georgofili. Ce.S.I.A. C.N.R. Porto Conte.

- BOVIO G., MANCA R., PERONA G.E., 1990 – *Individuazione di incendi boschivi con immagini telerilevate*. Monti e Boschi, 4, 5-10.
- CAMIA A., 1993 – *Analisi delle serie storiche per la pianificazione antincendi boschivi*. Cellulosa e Carta, 3, 34-39.
- , 1994 – *Impiego dei sistemi informativi geografici per la gestione delle risorse naturali in aree di limitata estensione*. Il giardino nella storia, nella scienza e nella natura. Corso di perfezionamento. Università di Torino, 153-162.
- MAF, ISAFA, 1988 – *Inventario Forestale Nazionale 1985*, pp. 464. Temi. Trento.
- MANZARI R., LEONE V., 1990 – *Il rischio di incendi nei boschi italiani: analisi del ventennio 1970-1989*. Cellulosa e Carta, 41, 6, 20-26.
- MARTIN E., 1988 – *Help with making crown fire hazard assesment. Protecting people and homes from wildfire in the interior west*. U.S.D.A. For. Ser. Gen. Tec. Rep. 251, pp. 213.
- MRAAF, CFS, 1995 – *Gli incendi boschivi nell'anno 1994*. Artigrafiche de Angelis, pp. 160.
- CHUVIECO E., CONGALDON R.G., 1989 – *Application of remote sensing and Geographic Information Systems to forest fires hazard mapping*. Remote Sensing of Environment, 29, 147-159.
- PAWLINA M.W., BUCKLEY D.J., STRICKLAND R., 1990 – *Automation of visible area mapping for fire detection lookouts*. GIS Symposium, 29-46. Vancouver.
- SETZER A.W., PEREIRA M.C., 1991 – *Amazonia biomass burning in 1987 and an estimate of their tropospheric emission*. Ambio, V. 20, p. 19-23.
- VIEGAS D.X., SOL B., BOVIO G., NOSENZO A., FERREIRA A., 1994 – *Comparative study of various methods of fire danger evaluation in southern Europe*. Proc. 2° Int.Conf. Forest Fire Research. Vol. II, 571-590. Coimbra.

Vittorio Leone

SOCIOLOGICAL ASPECTS
IN THE PHENOMENOLOGY
OF FOREST FIRES

SOCIOLOGICAL ASPECTS IN THE PHENOMENOLOGY OF FOREST FIRES

I will, as much as possible, limit the presentation of data by which to set the phenomenon in perspective. According to IUFRO estimates, more than 10 million hectares of forested land on a world-wide scale, equal to 0.3% of the total forest area, are affected by fire each year (CALABRI, 1991).

In southern regions of the European Union, an average of 550,000 hectares of forest stands are ravaged by 35,000 fires every year. This is about 1.6% of the forest area held to be at risk and, assuming the phenomenon to be distributed evenly in time, this means 100 fires a day, five, every hour of the day (VELEZ, 1990).

It is estimated that in Italy there are on average 15,000 fires a year, which burn 64,000 hectares of forest land, to which 84,000 hectares of unforested land can be added. In our country there are about 42 fires a day, almost two an hour.

Between 1989 and 1993, the total economic damage caused in Italy by the phenomenon has been estimated at 2,300 billion Italian lire per annum, with an average incidence per hectare of 34 million lire, and this limiting the analysis just to timber production, recreational functions, watershed protection and the service of climate stabilisation which the forest offers (PETTENELLA, 1994).

When talking about fires, we have to cope with deep-seated commonplaces, the first of which is that we are dealing

with a phenomenon linked to modern models of life, to our increased mobility, to tourism and recreational activities which draw increasing numbers of visitors to the forest (MORANDINI, 1976). This is an incomplete interpretation, which induces a partial analysis of the phenomenon, seen essentially in terms of negligent behaviour.

In actual fact, fire is a traditional instrument for the management of Mediterranean ecosystems, the long-established use of which in agriculture, silviculture and livestock-breeding is documented, as well as being testified by ritual custom. The change from an instrument of agricultural management to an element of assault and alteration is therefore intuitable.

Authoritative studies have demystified that likely golden age when man and the forest lived in harmonious accord, emphasising that intervals between fire outbreaks in the past were not unlike current ones (AMOURIC, 1985 and 1993; SULLI, 1987), even though the causes were different.

Forest fires are not autonomous phenomena and neither are they fatalities, but they are a symptom of socio-economic problems today linked to a complex series of circumstances: the depopulation of vast areas, the abandonment of agriculture, the distribution of new settlements in rural settings, the diffusion of transportation infrastructures, the burgeoning of interests which often conflict with the conservation of natural resources.

Although it has been established that fire has, in thirty-three years (1962-1994), overrun 1,613,000 hectares of forested land (the equivalent of 18.7% of the total national forest area) and about 1,750,000 hectares of agricultural area, little is known of the causes of the 275,000 officially registered fires over the same period. In concrete (but purely theoretical) terms, these figures mean three fires per square kilometre of forest surface, one about every 650 metres.

These forest fires are confronted by a defensive mechanism based on waiting, pre-arranged for acting once the fire has started and limited to contingent intervention, with the intervention-event link. In these conditions, prevention is inevitably condemned to failure (ALEXANDRIAN and GOUIRAN, 1990). Indeed, there is no organic plan available where intervention is based on a knowledge of the causes and with the aim of tackling them, rather than just mitigating the consequences of fire.

On the other hand, the scanty knowledge of the problem constitutes a generalised shortcoming. Consider that, in the period from 1980 to 1988, *Forestry Abstracts* reviewed 62,870 papers; of these, 1,154 concerned research on fires, but only seventeen of them (the equivalent of about 0.3 per thousand) referred to the causes (LEONE, 1990).

At a world level, the problem is assuming considerable dimensions in terms of consequences on global change and it must, therefore, be tackled with greater competence (EUROPEAN PARLIAMENT, 1993). It is not by chance that, in the recent EU research programme, *Environment and Climate*, specific attention was turned to fire statistics and to the analysis of the causes of the phenomenon, which, on the occasion of the International Decade for Natural Disaster Reduction (IDNDR), was included among natural hazards.

This is the first fixed point: forest fires are not a natural calamity, but rather an anthropogenic phenomenon with an exclusive, direct dependence on social behaviour, whether voluntary or involuntary. The forest also burns because somebody has a particular interest in setting fire to it, while the motivations that countryside dwellers have for avoiding that this should happen are less substantial than they once were, when the forest was a reserve of raw materials and a source of instruments of work for the whole community.

In fact, natural causes do not justify the scale, nor the

clamorous evolution of the number of fires, repeatedly defined in the European Union as a *social aggression towards the forest*. Following the recent admission to the European Union of Nordic countries with a flourishing forest economy, this definition may represent a dangerous precedent for penalising the forest sector of Mediterranean countries considered *at risk* according to Reg. 2158/92 (EEC).

The overall number of fires registered in official statistics in actual fact expresses the number of times that man's action is responsible for such an event, since, according to the EUROSTAT classification, *natural* causes are negligible. Among these lightning prevails, at the origin of a scanty minority of events which oscillate between 1 and 2% according to national statistics. In other situations, on the other hand, lightning constitutes the primary cause: for instance, in Canada it is in first place among ascertained causes, with over 60% of cases. Values to the tune of 58% can be found in the Northern Pacific States.

In EU statistics, the higher values refer to the Pyrenees, the departments of Var, Ardeche and the Hautes Alpes, reaching their maximum on the Greek island of Thassos, where over 50% of fires can be put down to lightning (KAILIDIS, 1992).

The incidence of fires in Italy, 66.3% of which are concentrated in the southern and insular regions (LEONE, 1995), does not correspond to the range of lightning activity, confirming that the role lightning plays is absolutely marginal. Fires sparked off by lightning may still, however, cause serious damage in far-off, inaccessible areas.

Other possible natural causes, though extremely rare, are mentioned in literature: meteorites falling, volcanic eruptions, sparks caused by the friction of rocky boulders in land slides (TRABAUD, 1989) and spontaneous combustion subjected, in the past, to imaginative, bizarre interpretations (AMOUR-

ic, 1985). The latter has often been mentioned by superficial reporters and sometimes even by sources which one would expect to be more rigorous: spontaneous combustion is possible only when fermentation processes take place without adequate dissipation of the heat produced. This happens in accumulations of organic substances, in industrial residues, in heaps of sawdust or chips.

The physical conditions which may spark off spontaneous combustion phenomena in the forest are, on the other hand, so limiting that the percentage of fires caused by such a phenomenon can only be extremely small (ARMSTRONG, 1973). The literature mentions rare cases of this kind, usually where peat deposits are concerned: 5% of fires in Bulgaria are due to this cause (KURPANOV, 1991) and in Spain, phenomena of spontaneous combustion have been found in the Rio Guadiana peat bogs (COMINI *et al.*, 1994). Spontaneous combustion is, therefore, extremely rare and is, in any case, absolutely independent of high summer temperatures which cannot spark off any phenomena of combustion but only encourage the fire to spread.

Such remote circumstances excepted, all fires can be put down to the action of man, including those caused by fortuitous sources which are defined as *accidental*, such as the action of the sun's rays concentrated in aerosol cylinders or in glass shards which function as a burning glass, high-frequency radar emissions, the electric arc created by high voltage electric cables, or else the action of catalytic exhausts.

These are all possible but highly unlikely causes, on a par with natural ones. They cannot, however, be accountable for the extent of damage and the rampant number of events, an increasing percentage of which start off during the night.

As regards Italy, about 98% of fires spring from man's action. They do not therefore, constitute unpredictable events, but a phenomenon which recurs periodically and

which is not subject to wide margins of variability, except as far as the number of events or the surface areas involved are concerned.

A classification would be of use in listing the most important reasons. For instance, FAO (DE MEO, 1986) identifies:

- causes external to the forestry sector;
- causes internal to the forestry sector.

Among the former, there is *voluntary, direct, conscious intervention*, dictated by:

- needs connected with agricultural and grazing practices;
- needs connected with hunting;
- needs connected with soil use;
- conflicting interests;
- pyromania.

Involuntary intervention external to the forestry sector comprises:

- farming and agricultural activities without cautionary measures;
- recreational activities and the increased urban pressure in general.

While, among the causes *internal to the forestry sector* are:

- the increasing marginality of forest resources;
- a wide-spread disregard for forest preservation;
- the outbreak of fires connected with job creation.

The classification adopted in Spain by ICONA is very similar, distinguishing:

- fires from which the starter hopes to benefit;
- fires from which the starter assumes he will not draw tangible benefit;
- fires caused for political reason.

Under the first group come motives ranging from destroying the forest cover in order to obtain land for grazing, to the use of fire for transforming rural terrain into building plots, to fire which generates jobs (in fire-fighting and reconstruction activities).

In the second group we find resentment against acts carried out by public authorities, ill feelings between private citizens and groups, conflicting interests, the opposition to hunting reserves, resentment against administrative sanctions, vandalism, or irrational acts.

Mentioned in a separate category are pyromaniacs, individuals affected by a rare personality disorder which affords a thrill in setting things on fire or else in contemplating the effects of the blaze as reported and amplified by the mass media, openly challenging the authorities while avoiding identification (TARREGA and LUIS CALABUIG, 1992). Such people are individuals with a lust for revenge against all and sundry, expressed in the irresistible impulse to spark off fires (BOUVAREL, 1974).

True pyromaniacs, in any case, constitute a minority in the vast panorama of arsonists. Their presence is scant enough to cast doubt on their actual existence, but the mass media rashly go to town on this in their quest for acceptable or credible scapegoats. As with instances of spontaneous combustion, it is an error to indicate pyromaniacs as initiators of voluntary fires because in this way psychologically unstable subjects, who are afflicted with an uncommon form of mental disorder, are held responsible for the end result of what is instead a lucid, determined criminal act, more properly sanctionable according to Art. 423 of the Italian Penal Code.

I now wish to examine some of the motives of greater import in the Italian reality, where a dramatic upward trend has been registered in the annual average number of events,

which have gone from 6,000 in the sixties to 12,000 in the eighties and 16,000 at the current moment. The phenomenon seems concentrated in the southern Italian regions, which have a modest forest density index. Voluntary causes are predominant, today representing about two thirds of the total number of recorded events.

Often quoted is the ratio between fire and grazing as prompted by the use of fire to eliminate non-grazed or scarcely «appetising» herbaceous and shrub species in areas which have a strong deficit in fodder production. In such a context (as normally happens in Sardinia), fire represents an archaic agronomic practice, which is criticizable but certainly low cost and able to ensure both the control of infesting species in areas where it would appear impracticable to resort to mechanical mowing (Various Authors, 1987) and stimulate the growth of tender, young shoots (MELE, 1993).

Although it can explain a lot, this practice does not cover all aspects of the phenomenon which, on a more thorough evaluation, also appears to express a predatory attitude, besides indicating a state of latent social conflict between shepherds, owners of grazing land and rural dwellers.

Apart from its function of land clearing, it appears likely that fire constitutes a form of warning or a latent threat, with the aim of underlining the agricultural and grazing use of the territory, linked to the craving for land for shifting sheep-farming.

It therefore serves as a warning signal to the world outside, an expression of aggressive behaviour, and it appears to be an instrument directed at hitting out at an asset belonging to an extraneous individual towards whom the hostility is felt (TAGLIAGAMBE, 1988).

The previous paragraphs explain the variability in localisation of fires, referring to vast and specific areas.

In other circumstances, such fires may be ascribable to

conflict between antagonist groups for grazing opportunities or watering places and for controversies linked to the archaic world of sheep-farming. Circumstances of this type have been reported in regions such as Liguria, Tuscany and Lazio, where the abandonment of rural spaces has prompted the immigration of Sardinian shepherds onto the mainland (LEONE *et al.*, 1989), with the obvious transfer of their own culture, as well.

In limited areas, such as the Gargano in Apulia, setting land on fire gives wilful emphasis to its use as grazing land, where sheep breeders who do not own land challenge farmers, against whom fire represents a brutal, though efficacious, factor of dissuasion and expulsion.

A considerable number of voluntary fires are linked to concrete interests, to real or presumptive benefits that the incendiary hopes to gain. Among these motives, there is one, widely reported throughout Italy, which is beginning to show up in other countries: fires lighted to create jobs (in fire-watching, fire lighting and in the following reforestation activity), known as the *fire industry*.

This is a situation which has already been reported in the literature. It has been amply described in the southern parts of the United States, in places where conditions of marginalisation and economic distress emphatically mark the areas which are more strikingly characterised by voluntary fires (SHOW and CLARKE, 1953; BERTRAND and BAIRD, 1975; DOOLITTLE and LIGHTSEY, 1979).

Fires for occupational reasons constitute an alarming reality in some southern regions of Italy where a minimum employment of rural labour was, in the past, guaranteed by public intervention in the realms of afforestation and fire-fighting (LEONE and SARACINO, 1993). The plans for fire-fighting, limited to fighting the fire once it has started, have led to a wide-spread policy of temporary employment, sometimes

characterised by very short periods (LEONE and SARACINO, 1990).

An alteration of the social context and the labour market is the outcome, resorting to precarious, barely-qualified labour, often with aims which have more to do with social welfare than with production, has sometimes given rise to a vicious circle, where the voluntary fire lit by seasonal workers can constitute an instrument for maintaining employment or for creating new job opportunities (C.F.S., 1992).

This vicious circle is linked, furthermore, to a distorted, instrumental interpretation of regulations regarding compulsory employment, in particular to the minimum duration of employment necessary to guarantee social security and welfare benefits, and which allows the worker, for the rest of the year, to offer agricultural labour to private citizens beyond the reaches of the regular, legal employment channels.

The temptation to use the threat of increasing the fire phenomenon to impose the need for temporary employment (TAGLIAGAMBE, 1988), is consequently anything but a theoretical, abstract likelihood.

In 1992, seasonal fire-fighters were defined as «*a protected and well-paid army, used for procuring votes, who set fire to the forest so as to be able to plant it anew*».

Concerning the fire industry, a discreet mention can be found in the 1985 Italian National Forest Plan. It was at length opposed by the forestry establishment in Italy who rejected an interpretation of the fire phenomenon linked to its own organisational patterns of seasonal fire-fighting activities, which are still, in precisely those areas which are hardest hit, widely centred on the use of seasonal workers.

Various research projects, based on the answers to questionnaires and interviews with personnel, have confirmed the magnitude of the fire industry (TAGLIAGAMBE, 1988; LEONE *et al.*, 1990; MARCHETTI, 1994) and today it is among the causes offi-

cially recognised in the statistics published by the Ministry for Agricultural, Food and Forest Resources (MIRAAF, C.F.S., 1995).

In Apulia, a region which is particularly afflicted with forest fires, the percentage of voluntary fires attributed to the action of unemployed labourers represents 14.04% of the causes ascertained by the official finding of the State Forest Service over the whole period of 1974-1989, with peaks of 20% in 1988 and 26% in 1989 (LEONE, 1990). Values over the last few years have, on the other hand, fallen to under 3% (C.F.S., 1995).

Clearly this is a very complex phenomenon which prospers where lack of interest, due to indifference or inurement to illegal behaviour is widespread, thus permitting that planned devastation of the land be accepted.

Even fires sparked off in protest against the failure to find employment or as an extreme form of remonstrance against the threatened closing of forest activities come under this logic, where the forest takes on the role of *hostage*.

In many cases, fire represents an opportunity for extortion or holding for ransom. This situation has been «borrowed» from urban realities where there is a marked onslaught of violence with fires or dynamite attacks to force the payment of unsolicited forms of «*protection*» or to obtain insurance pay-outs unlawfully.

The regions characterised by a high percentage of voluntary fires are the same where there is a considerable number of incendiary and dynamite attacks for purposes of intimidation.

We are certainly not dealing with a relationship of cause and effect, but rather with the selfsame attitude of widespread illegality, often intended as the only possible answer to social uneasiness.

Still more complex is the interpretation of the serious

upsurge of damage within protected areas, especially those newly established.

The protest against the loss of benefits consequent to the institution of protective measures seems insufficient to enable us to interpret the increase in the devastation of man's own habitat. Likewise, there seem barely grounds for accusing vaguely identified groups who would hardly endure the harshness of new management regulations with regard to the land.

In many areas, after the passage of Law N. 428 of 29.10.1993 (which earmarked the sum of thirty billion Italian lire for fire-fighting and for specific measures in environmental preservation and protection in preserved areas) devastating episodes broke out which can be interpreted as a deprecable indication on the use of the land, where destruction appears more advantageous than correct management.

Even the chance to eliminate restrictions, thus enabling construction programmes to be set in motion, has repeatedly been considered a very probable cause of fire.

This cause does not seem very plausible here in Italy on account of the reasonably strict regulations contained in Law N. 47 of 01.03.1975 and the subsequent Law N. 428/93 which prohibit unauthorised transformations in the use of areas overrun by fire.

Research commissioned by the Ministry of Agriculture, Food and Forest Resources, based on interviews with the personnel involved in fire-fighting, has put forward the hypothesis that, in zones where real estate for secondary residential use has particular market attraction (such as the area of Olbia in Sardinia), fires on a large scale may, conversely, represent an extreme form of intimidation forcing owners to sell off, in a general plan of land possession which is not unrelated to money laundering (MARCHETTI, 1994).

In other countries, however, fire caused by building inter-

ests appears to be a dangerous reality. So it is that, in Greece, such circumstances began to spread on the announcement – previous to the political elections of 1993 – of the issuing of regulations ratifying unauthorised building on fire-ravaged, previously-forested state-owned terrain belonging to the state, thus causing anarchic forms of occupation of land to exploit for building (PAPASTAVROU, 1992; DIMITRACOPOULOS, 1994).

A conclusion can be drawn that, following changes in needs and customs which have come about since the War, the fire problem – in Italy, too, as in the whole Mediterranean area – has assumed different characteristics compared to the past.

There are two factors in the changed situation:

- a decline in the direct economic value of forests which have therefore become less protected and the simultaneous upgrading of indirect values;
- a marked increase in the number of fires and shifts in the range of their causes.

After the period of colonisation for agricultural and settlement purposes, when fire was the less wearying and more powerful instrument in conquering new territory, today we are witnessing a drop in fires of agricultural origin and their large-scale replacement with involuntary fires, testifying to the slight familiarity and scarce respect towards nature. There is recent news of the proliferation of fires unwittingly set off by illegal emigrants in the border areas between Greece and Albania (DIMITRACOPOULOS, 1994).

At the same time the worrying, increasing trend in voluntary fires has become more marked. This is an undeniable reality, grown to enormous proportions, proved by the capture (though it rarely so happens) of confessed criminal incendiaries and by the finding of primitive (but not for this

less efficient) timer devices, indicating the wish to carry through the destructive act, carefully choosing the place, time and method of ignition, also taking into account meteorological conditions favouring a quick spread of the fire.

The individual with the greatest responsibility for the impact on green areas is, therefore, not the careless tourist nor the farmer intent on agricultural operations (though they do represent a frequent cause of fire), but he who acts with premeditation, prompted by impulses which often escape our abilities of interpretation.

The solution to the problem cannot lie just in the technical bolstering of the defensive system, but it solicits a set of actions and measures to be carried out in a co-ordinated manner, preventing the lack or inadequacy of one or more of the components from acting as a limiting factor, reducing the overall efficiency of the integrated system.

The actions to be carried out are those inspired by the theory of «integrated fire management», can be summed up as follows:

- an accurate diagnosis of the phenomenon, so as to orient prevention and carry out appropriate intervention at the time of emergency;
- the education and mobilisation of the population for the formation of a better ecological conscience and for the acquisition of an awareness of the risk;
- the application of preventive silviculture and the creation of defensive infrastructures at the service of the district;
- the organisation of prompt fire discovery and immediate action services, counting on professional personnel who are trained and equipped with self-sufficient ground means for a first attack, to be aided, if necessary, by aircraft;
- a commitment to identify those responsible and to impose harsher and more efficacious measures against them;
- incisiveness and scrupulousness in the application of the

regulations of Law N. 428/92, which prevents the unauthorised transformation of fire-ravaged areas.

However, it is necessary to rally against inurement and tolerance toward this phenomenon which jeopardises assets and human lives, discourages investment in forestry and, when all is said and done, constitutes a serious pathology of the rural environment, triggering off serious and often irreversible processes of alteration, the epilogue of which is desertification.

REFERENCES

- AA.VV. 1987 – *La lotta contro il fuoco*. La programmazione in Sardegna, 109/111: 27-31.
- ALEXANDRIAN D., GOUIRAN M., 1990 – *Les causes d'incendie: Levons le voile*. Rev. For. Franç. XLII, Num. Spec. «Espaces forestiers et incendies», 33-41.
- AMOURIC H., 1985 – *Les incendies de forêt autrefois*. CEMAGREF-DATAR, Aix-en-Provence.
- , 1992 – *Le feu à l'épreuve du temps*. Tèmoins et Arguments. Narrations.
- ARMSTRONG J., 1973 – *Spontaneous combustion of forest fuels: a review*. For. Fire Res. Inst., Ottawa. Inf. Rep. FF-X-42.
- BERTRAND A.L., BAIRD A.W., 1975 – *Incendiarism in Southern Forests: a decade of sociological research*. South. For. Exp. Stat. Bull. 838.
- BOUVAREL A., 1974 – *Les incendiaires*. Rev. For. Franç. Num. Spec. «Les incendies de forêt», Tome 1: 107-109.
- CALABRI G., 1991 – *Problèmes et perspectives concernant les incendies de forêt, leur prevention et leur maitrise*. Proceed. World Forestry Congress, Paris, Vol. 2.
- CFS, SERV. AIB 1992 – *Aspects sociaux, économiques et culturels des incendies de forêts en Italie*. Proceed. Sem. on Forest Fire Prevention, Land Use and People. ECE/FAO/OIT, Athens, Apr. 1987.
- CFS - COORD. REG. BARI 1995 – *Relazione sull'attività antincendio nel 1994*.
- DE MEIO G., 1986 – *Riflessi economici della distruzione boschiva*. Cellulosa e Carta, 3: 6-7.
- DIMITRACOPOULOS A., 1994 – *Saison 1993 des incendies de forêt*. Nouvelles internationales sur les incendies de forêt, 10: 11-12.

- DOOLITTLE M.L., LIGHTSEY M.L., 1979 – *Southern woods-burners: a descriptive analysis*. South. For. Exp. Stat. Res. Pap. SO-151.
- KAILIDIS D., 1992 – *Forest Fires in Grecia*. Proceed. Sem. on Forest Fire Prevention, Land Use and People. ECE/FAO/OIT, Athens, Apr. 1987.
- KURPANOV Y., 1992 – *Forest protection against fire in Bulgaria: making the forests less flammable*. Proceed. Sem. on Forest Fire Prevention, Land Use and People. ECE/FAO/OIT, Athens, Apr. 1987.
- LEONE V., 1990 – *Causes socio-économiques des incendies de forêt dans la région de Bari (Pouilles, Italie)*. Rev. For. Franç. Num. Spec. «Espaces forestiers et incendies».
- , 1993 – *El problema de los incendios forestales y su relacion con el medio rural y sus habitantes*. Semin. Europeo ASAJA Sevilla, Oct. 1993.
- , 1995 – *Gli incendi negli spazi rurali: problemi e prospettive*. L'Italia Forestale e Montana (in corso di stampa).
- LEONE V., CORONA P., SARACINO A., 1990 – *Studio sulla percezione degli incendi boschivi: una ricerca sperimentale tra gli addetti ai lavori*. Cellulosa e Carta, 5: 38-47.
- LEONE V., MINOTTA G., PISANTE M., SARACINO A., 1990 – *Incendi boschivi e fattori economici, strutturali e sociali del territorio: definizione di una «geografia degli incendi» per l'Italia*. Monti e Boschi, 5: 13-20.
- LEONE V., SARACINO A., 1993 – *Attività antincendio e manodopera occasionale: analisi del periodo 1984-1989*. Cellulosa e Carta, 5: 30-37.
- MARCHETTI M., 1994 – *Pianificazione antincendi boschivi: un sistema informativo per la modellistica, la cartografia, le cause, i danni*. MIRAAF, Collana Verde, 93.
- MELE A., 1993 – *Il ruolo degli agricoltori della Regione Sardegna nella prevenzione degli incendi forestali*. Semin. Europeo ASAJA, Sevilla, Oct. 1993.
- MIRAAF-CFS 1995 – *Gli incendi boschivi nel 1994*.
- MORANDINI R., 1976 – *Les problemes de conservation, de gestion, de reconstitution des forêts méditerranéennes: priorités pour la recherche*. UNESCO, Note Techn. du MAB nr. 2.
- PARLAMENTO EUROPEO, 1993 – *Incendies de Forêts en Europe du Sud: Evaluation des Actions communautaires: vers une cooperation internationale?* S.T.O.A., 1-272.
- PAPASTAVROU A.C., 1992 – *Social, economic and cultural aspects of forest and wildland fires in Greece*. Proceed. Sem. on Forest Fire Prevention, Land Use and People. ECE/FAO/OIT, Athens, Apr. 1987.

- PETTENELLA D., 1994 – *Il costo degli incendi forestali*. Ambiente, Risorse, Salute: 24-29.
- SANCHO COMINS *et al.* 1994 – *La tradicion e innovacion en el paisaje agrario: Los efectos de la PAC en la region central espanola*. El Campo, 131: 215-234.
- SHOW S.B., CLARKE B., 1953 – *Forest Fire Control*. F.A.O. - Rome.
- SULLI M., 1987 – *Gli incendi boschivi in Italia: tentativo di analisi quantitativa dalla unit  ad oggi sulla base della letteratura periodica forestale*. Ann. Ist. Sper. Selvicoltura, Vol. XVIII: 293-321.
- SUSMEL L., 1983 – *Il problema degli incendi boschivi nell'ambiente mediterraneo: cause, prospettive, rimedi*. Atti Conv. Intern. Studi problemi degli inc. boschivi in amb. medit. Bari, ottobre 1983.
- TAGLIAGAMBE S., 1988 – *Atteggiamenti e reazioni in Sardegna nel confronto del problema degli incendi*. Atti Convegno Lions Club «I boschi e il fuoco nel bacino del Mediterraneo», Cagliari, Aprile 1988.
- TARREGA R., LUIS CALABUIG E., 1992 – *Los incendios forestales en Leon*. Univers. de Leon, Secr. de Publicac.
- TRABAUD L., 1989 – *Les feux de for ts*. France-Selection, Aubervilliers, 278 pp.
- VELEZ MU OZ R., 1986 – *Incendios forestales y su relacion con el medio ambiente*. Rev. Estud. Agro-Sociales, 136: 195-221.
- VELEZ R., 1990 – *Mediterranean Forest Fire: a Regional Perspective*. Unasylva, Vol. 41, 162: 3-9.

ROUND TABLE «THE FOREST AND MAN»

Florence, 23 May 1995

The round table participants discussed and passed the following motion by majority vote:

FINAL MOTION

The forest is a complex biological system that plays a determining role in maintaining life on this planet.

Like all living systems, the forest is an entity that has «an intrinsic value». It is a subject with rights that must be protected, conserved and defended.

Man must overcome and progress beyond the concept of being able to dispose of the forest for his own needs and consumption. The forest belongs to everyone and must be handed down to future generations in optimum condition.

The forest is an inexhaustible source of knowledge. It is an objective reference point for the creation of culture.

It is necessary that young people, both foresters and laymen, be fully aware of the meaning and value of the forest ecosystem.

The forester plays a determining and decisive role in forest management. In his encounters with society he has a specific duty: to work in such a manner as to increase the system's functionality.

Forest management is achieved by careful and aware cultivation intervention, going beyond the current linear schemes which are in conflict with the system's complexity.

Cultivation activity that contributes to the conservation of

the forest has an ethical meaning. The forester must be prepared to think globally and act locally.

Planning is an indispensable tool for enhancing the biodiversity, the dynamism and the equilibrium of the forest, in relation to other ecosystems as well.

The process of development of forestry knowledge is moving within the context of a new scientific paradigm: the paradigm of complex systems.

In this phase of cultural and scientific transition, research and experimentation play a crucial role for the creation of new relationships between *man and nature* and *forest and man*.

In order to promote progress in forestry sciences, it is necessary that technical knowledge be the sum of theoretical, anthropological and sociological knowledge.

Culture moves forward in harmony with the spirit of the times. Forest preservation and conservation are forms of management and represent the connecting link between ecology, economics and ethics.

The renaturalisation of the cultivated forest is the main goal and comprises the forester's *wisdom*. The aim is to favour the self-organisation and complexity of the forest system.

Complex biocoenoses are economic realities that contribute not only to wood production, to the conservation of the land and the environment, but they also have a historic-cultural value.

In order to be effective, forest management requires a forestry policy that is not linked to emergencies, but rather aims at enhancing the forest heritage and wealth.

The creation of a special fund for protecting private property from loss of income is indispensable.

The forest is essential for making the present liveable, and the future possible.

WE WOULD HOPE

that the competent authorities, at the European, national, regional and local levels adopt a far-reaching policy which, in the short term provides for an adequate increase in financing for forest management, enlarging forested areas and augmenting research and experimentation, and in the long term, launch suitable programs for promoting the «culture of the forest» and creating a turning point in the forest-man relationship.

The forest and man

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