

## **COST E42 Growing Valuable Broadleaved Tree Species“ Report of Italian partner**

**MC members: Mario Pividori and Maria Emilia Malvolti**

### **1.) Introduction**

#### a. Total forest area

Two main sources of information on the forest cover structure and distributions are available in Italy:

- a) the National Forest Inventory carried out in 1985-86 that adopted a broad definition of forest land including land covered by shrubs and scattered trees (total forest land extension is 8.6 M ha);
- b) the National Institute of Statistics publishing annual data on forest land extension (the most recent data is of 6.7 M ha) including only the forestland within non-abandoned public and private farms.

However, abandoned agricultural and range land conversion in natural forest is by large the most relevant change in land use in Italy, as confirmed by other sources of information (i.e. CORINE3, an European Commission project to collect environmental data in all EU member countries) where total Forest Land Cover is 7.2 M ha, 9.4 M ha considering also shrubs and scattered trees.

Making reference to more detailed source of information (the National Forest Inventory) forests in Italy extend over 8,675,100 ha (10,000 Mha according to FAO, FRA 2005, Country Report, Italy), corresponding to 29% of the total land area. High forests make about 25% of this surface, coppices more than 40%. The remaining 35% are both "*specialised production forests*" (i.e., plantations for timber or wood paste production, tree farming, or non timber products woods: cork, chestnuts, cherry, walnut etc.) and "*other forests*" such as scrubs, marquis, and rocky or riparian woods all rarely managed (Cristiana Colpi et al., 1999).

Italy is a major importer of hardwood and softwood lumber, since its rugged terrain and disjointed forestland restrict domestic production. In 2001, 80% of the raw materials used for manufacturing furnished wooden products are imported (Encyclopedia of the Nations: Europe: Italy.)

#### b. Most common species

Noble hardwood species in Italy are often scattered in the countries as single trees or in mixed manmade stands, also in the forest noble hardwood are present as single trees or small groups in several forest typology especially in secondary forests grown up on fallow lands mainly in the mountain (both Alps and Apennine). The presence and the different behaviour are depending from several factors as, for instance, the competition from other tree species, the more or less appropriate local site conditions which strongly influence the development and the survival of the trees, the aptitude of one species to live in mixtures, the types and quality of mixed stands, the silvicultural interventions.

During the last 20 years, noble hardwood species were used almost in mixed plantations following the EU regulation on the reforestation of agricultural lands (Reg. CE 2078 and 2080/92). From 1990 to 2000 about 140.000 ha have been reforested in Italy using public financing supports (Anderle et al 2002).

Plantations have been established using different kind of species classified as native of Italia peninsula. The more common species studied and used are walnut, wild cherry, ash, maple, and birch. Other species of interest are chequer tree (*S. Torminalis*), service tree (*S. domestica*), and pear tree.

#### c. Inventory results (area of forest types, absolute and relative amount of target tree species, etc.)

At the moment the available data of the old Italian forest inventory (1985) are not able to describe satisfactorily the actual situation, mainly because of the great increase of forested areas in the mountain regions in which the valuable broadleaved species play a very important role. For further and reliable information, it needs to wait for the results of the new inventory in 2007.

d. Relevance of valuable broadleaved tree species regarding ecological, economical and social aspects

Whilst hardwoods continue to be attractive for local forest services and for activities related to selection, improvement and legislation, institutions active on research aspects on a wider scale are relatively few. Promotion and successful management and conservation of Noble Hardwood species need to take into consideration factors such as competing or alternative tree species and the special characteristics and requirements of target species in the environment in which they occur. General guidelines are difficult to develop because management practices will differ according to prevailing site conditions as well as between individual species. For these reasons, in the next chapters we will present the main research developed, or still in progress, by the scientific groups included in the E42 Cost Action.

*Juglans regia* L., common walnut, is one of the older plants for fruit and wood production well known by man. Fossil remnants testify the presence of walnut in Europe since prehistorical times. The climate, changes due to the alternate glaciation's periods, as well as man selection, modified the geographical distribution of this species. In Italy walnut is cultivated since roman times; Romans spread *J. regia* in Spain, France, Germany, probably in England. Actually walnut is cultivated mainly in temperate regions and natural and naturalised populations are very rare and highly fragmented. In the Italian modern plantations walnut for wood production is traditionally used as pure or, nowadays, intercropped species and mixed plantations, from north to south of the peninsula, cultivated from the sea level to over 1000 m a.s.l. The extension of walnut plantations in Italy, considering any forms, is about 45 thousand ha (Paris, pers. com.)

*Prunus avium* L., wild cherry, grows naturally all over Italy from near the sea level up to about 1400 m a.s.l. It is easy to find it as single seed tree or small groups in broadleaved mixed forests mainly in coppice managements systems. In farm forestry contest, the first plantations (about 15 years ago) were pure, now it is mainly used in mixed stand with other species (e.g. common walnut).

*Fraxinus* sp. (*Fraxinus excelsior* L., *F. oxyphylla* M. Bieb), Ashes, are naturally present in mixed stands as single seed trees or small groups from the plane up to 1600 m a.s.l., but in the last 30 years they developed pure stand as secondary forest on fallow land (meadows and pastures) mainly on the Alps. These stands are today diffuse on many thousands of hectares, but usually the single stand dimensions are very small (rarely over one hectare) In the farm forestry context they are used usually in mixed stand as main or accompanying species.

*Acer* sp. (*Acer pseudoplatanus* L., *A. platanoides* L. *A. campestre* L.), Sycamore and Maples trees, are distributed and cultivated more or less as the ashes species.

Chequer tree (*Sorbus torminalis* Cranz), service tree (*Sorbus domestica* L.), and pear tree (*Pyrus piraster* Burgsd.) are *Rosaceae* very rare in Italian broadleaved forest. Nowadays they are quite disappeared because of the common coppice management systems. They are used in farm forestry in mixed stand as main species.

Birch (*Betula pendula* Roth) typical primary and secondary pioneer tree is diffused mainly in the western Alps and in the Apennines often present in natural forest in gaps or in primitive stands (e.g. on rocks and landslides). In the last decades it has developed secondary stands on wide abandoned pastures areas, for instance, in Piemonte region where over than 20.000 hectares are nowadays pure birch stands. This species is at the moment not used in farm forestry.

Other species very important in Europe not only for fruit and timber but also for rural diversification, local economies and cultures and for the contribution to the landscape and

environment is chestnut. Nowadays, *Castanea sativa* (Mill.) covers about 800 thousand ha only in Italy. This species characterised by different domestication levels (natural populations, coppices orchards), could be considered as "a study model" for the other noble hardwood species.

## 2.) Completed research

Several research Institutes belonging to Governmental Organizations (Universities, CNR (National Research Council) and CRA (Council of Agricultural Research)) are the members of the Italian team in the framework of the Cost Action E42

The Institutes are studying, since many years ago, forest and agroforestry species by basic and applying research with particular attention to Noble Hardwood species because of their importance. Scientists involved in these studies often participated in the same international and/or national projects. Common aims are to deep the knowledge on genetics, physiological, ecological traits of the considered species and to study the appropriate strategies for conservation, improvement and management of plants in forest and field trials, as well as to improve cultivation techniques in natural forest and in farm forestry plantations.

In order to deep the knowledge on walnut genetic resources (natural/naturalised material as well as selected germplasm), the CNR Institute of Agro-environmental and Forestry Biology (IBAF), approached studies utilising different kind of genetic markers (isozymes, RAPD, ISSR, SSR).

The researches have been carried out at various levels and with different finalities: (*•a*) *Analysis of genetic resources in Europe and Eurasian continent*; (*•b*) *Analysis of inter-specific hybrids J. nigra x J. regia for wood production (French material)*; (*•c*) *Evaluation of genetic diversity between and within fruit varieties aimed to certification*; (*•d*) *Study of mating system*; (*•e*) *Construction of a genetic integrated map in order to identify loci controlling quantitative characters*.

In addition several studies have been carried out order to improve the knowledge on cultivation systems and to define different typology of pure or mixed plantations with walnut and other noble hardwood species. These researches had different finalities: (*a*) *Definition and comparison of different typology of pure and mixed plantations using noble hardwood (especially walnut and wild cherry), shrubs, nitrogen fixing trees and other accessory species*; (*b*) *Definition of different cultivation systems (pruning and thinning systems)*; (*c*) *Valorisation of secondary ash-maple secondary forest for the production of good quality timber testing different thinning system*.

Main results: In spite of the general low genetic variability among the analysed Eurasian walnut populations, Chinese-ones appear to conserve a good level of variation different from the Europeans. Strong differentiation of adaptive traits can be assumed among populations located in different ecological conditions, as well as a strong influence of selection processes (especially in relation with biotic and a biotic stresses and human pressure). Among the European provenances, the Italians resulted the most variables. The study of mating systems showed that walnut in Italy prefers the out-crossing and that self-pollination is absent. Molecular markers (isozymes, RAPDs, ISSR and SSR) were a powerful tool in varieties and hybrid genotyping. Using an intra-specific cross, a preliminary molecular map was constructed in walnut (female map 82.73% of the genomic size; male map 42.89% of the genomic size; common groups 32.2% of the genomic size)

Concerning the studies on walnut cultivation, agroforestry systems seem to be more effective than pure plantations for the restoration of degraded agro-ecosystems and for the preservation of rural landscape. Walnut stem growth (Paris et al, 2005) and timber quality (Paris et al, 2006) are often improved due to enhanced tree care, better site quality and synergisms among plant/system components, especially for soil water resources (Lauteri et al, 2006). Farmers' reactions to innovative agroforestry systems have also been studied (Pisanelli et al, 2006). In addition provenances of walnut, collected across Europe, have been compared, finding strong genetic variability for adaptive and wood quality traits in a network of juvenile field tests across Europe (Fady et al., 2003). This last activity, currently blocked due to lack of funding, deserve further development.

Furthermore, in the CNR-IBAF, during a decade, chestnut is studying as "model species". At the beginning a large inter-population genetic divergence and a hybrid zone located in the Ponto-Caucasian region was found. Investigation on the functional meaning of this variability highlighted distinct mechanisms of response to differential water availability (Villani et al., 1992; Lauteri et al., 1997 a). A trial of various provenances, set up to compare the performances of genetically differentiated forms of European chestnut, revealed also marked differences in some physiological traits (capacity in photosynthesis, transpiration, stomatal control and water use efficiency) as well as morphological (seeds and leaves traits) and phenological traits (bud burst, bud set, growth), and suggested the presence of structural and phenological mechanisms of adaptation to summer water shortage and to recurrence of possible late frost events. These results have stimulated recent studies devoted to define: a) the effective plasticity of European populations in the context of a changing environment; b) the genetic determinants of those adaptive traits through the construction of a genetic linkage map and QTL identification. Thus an F1 intraspecific mapping progeny was obtained and a linkage map (isozymes, ISSR, RAPD, AFLP, SSR markers) was constructed (95% saturation). QTLs for bud burst and Delta (as a measure of water use efficiency) were found. Transferability of microsatellite markers between the Fagaceae family (*Quercus robur* and *C.sativa*) is demonstrated.

These researchers were developed in the framework of the national and international projects: AIR3 CT92 0142; FAIR III CT96 1887 "W- BRAINS", CASCADE (EVK2-CT-1999-00006) (coordination ); DELTA (FAIR1 CT95-0781); CAST (IEV5V CT94 0432); STEP (PL 900257 CT90-0049); BIOFORUM (EVK2-2000-00769);MIPAF "Arboricoltura da legno" sottoprogetto "Latifoglie Pregiate", MIPA "Analisi di caratteri complessi in piante forestali mediante tecniche molecolari", MiPAF "Riselvitalia" Sottoprogetto 1.1 "Biodiversità e Produzione del materiale forestale di propagazione"; MiUR "Biofrum",. MAE (L. 401/1990) (2003 e 2004):Agroforestry: agro-food, environment, and Bilateral Cooperation Agreements between CNR MTA (Hungarian Academy of Forestry), CAAS (Chinese Academy Agricultural Sciences), CAF (Chinese Academy of Forestry).

### 3.) **Recent research** concerning valuable broadleaves

#### **WORKING GROUP 1 "Basics of growing valuable broadleaved tree species"** (Responsibles Fulvio Ducci, Piero Belletti and M. Emilia Malvolti)

The researches concerning genetic aspect are carrying out to study genetic variability and genetic differentiation among populations and provenances, in order to get knowledge useful for a more rationale planning of activities linked with reproduction material and improvement.

- CNR-IBAF (Institute of Agroenvironmental and Forest Biology), Maria Emilia Malvolti, Fiorella Villani, Marco Lauteri, Piero Paris, Via Marconi 2, 05010 Porano Italy

Research is mainly focused on walnut sp. (*Juglan regia*, *Juglans nigra* and inter-specific hybrids) and chestnut (*Castanea sp.*) are in progress using a multidisciplinary approach including genetics (molecular markers), physiology and agroforestry.

#### *Juglans sp.*: Identification of Italian walnut ecotypes abandoned or neglected

In order to contrast the erosion and to properly conserve, manage and reevaluate the genetic resources of Italian walnut, possible ecotypes, naturally adapted and still present in Italy have been researched. Leaves and fruits have been sampled in three localities of Campania region, and in four zones of Abruzzo region. The sites are located at different altitudes and climatic conditions. Materials have been collected on a total of 276 plants. Molecular, morphological and preliminary biochemical analyses have been carried out on this germplasm and on material belonging to 80 plants of 4 famous Italian walnut varieties (Bleggiana and Feltrina, North Italy; Sorrento and Malizia, Southern Italy), in order to have a comparison model. 134 ISSR, morphological and biochemical data have shown peculiar characters for Montella (hill, Campania) and Pescasseroli (mountains, Abruzzo) in comparison with the other accessions. Because of the peculiar

environmental conditions of their locations, the effect of the temperature on the fruit development and fat acid contents, it is possible to suppose that Montella and Pescasseroli are ecotypes which could be utilised as essential fat acid source and as material for reforestation of mountain zones. Research is still in progress.

Study of interspecific natural hybrid progenies by dominant (RAPD, ISSR) and codominant (microsatellites) markers. This study is in cooperation with CRA-ISSEL (Fulvio Ducci), CRA-ISF (Inst. for Fruit Crops) and the Univ. of Budapest (Agnes Major) is ongoing in the framework of a PhD thesis. Persian walnut (*J. regia*) and Eastern black walnut (*Juglans nigra*) are economically important species for high quality timber and edible nut production. *Juglans regia* is an indigenous species of Eurasia from the Balkans to southwest China. *Juglans nigra* is native to the Eastern part of North America. Both species are widely spread in Europe and the natural hybridisation between the two species is possible. Studies on hybrids French progenies showed that they are fast growing and more resistant to frost and flooding damages than *J. regia*, but the quality of timber is poor. Hybrid germplasm could be successfully employed in reforestation of agricultural lands. Our purpose is to characterize natural interspecific Italian hybrids and their parents in the tentative to obtain controlled material giving plant useful for quality timber production. CRA ISSEL, in Italy near Vicenza, identified a population including *J. regia*, *J. nigra* and some natural hybrids. All the plants of this populations and all individuals *J. regia* around the plot were collected and analysed in CNR-IBAF by molecular markers: ISSR, RAPD and SSR. All the analysed plants were characterised by their multilocus genotype. Performing microsatellite genotyping and cytological analysis a triploid tree with two genome-parts from *J. nigra* and one part from *J. regia* was discovered ( $2n = 48$  somatic chromosomes). After this step, progenies of each *J. nigra* putative mother were collected. These plants were conserved in the nursery of CRA-ISSEL and morphological and phenological traits have been registered. Molecular SSR markers have been analysed in the CNR-IBAF. Even if the pedigree analysis and parentage testing are still in progress, the preliminary results show that in particular two *J. nigra* plants produce hybrid progenies. The paternity analysis identified in some case only one father, in others a pool of putative mail parents. At the present the CNR-IBAF is developing the research of SNIPs to study markers for functional traits (bud burst)

Modelling of agroforestry system. The Italian draft proposal of the Rural Development Plans (2007-2011) expects financings the farmers for the establishment of agroforestry systems. In the period 2001-05 the European Project S.A.F.E. (Silvoarable Agroforestry for Europe-[www.montpellier.inra.fr/safe](http://www.montpellier.inra.fr/safe)) developed new computer simulation models (Plot-SAFE and Farm-SAFE) for the simulation of the profitability of silvoarable systems. Preliminary simulations results show that often modern silvoarable systems (with walnut, cherry tree and hybrid poplars) are more profitable than forest plantations (100% of the simulations). Preliminary projections indicate that the new agroforestry models potentially can be spread on 90 millions ha of agricultural lands across Europe, and on 65 millions ha can effectively contribute to the mitigation of environmental emergencies (contamination of the waters from the nitrates, soil erosion, loss of biodiversity). The SAFE simulation models need to be further tested and validated. Furthermore, a simpler, user friendly version of the Plot-SAFE simulation toll need to be developed in order to be used by forest and farm officers and professionals, in order to optimise land use options, choosing the more suitable and profitable cultural system (forest plantation vs. agriculture vs. agroforestry)

*Castanea* sp: Functional genomics: The activity will include comparative QTL mapping across related species (*Quercus*, *Fagus*) and identification of candidate genes related to some adaptive traits such as bud burst, bud set, Delta (as indicator of water use efficiency) and storage carbohydrate. It will be carried out using the chestnut F1 mapping progeny available at CNR-IBAF. In this context, development and use of new markers specific for chestnut are also planned.

Population genetic/functional diversity: Data related to genetic (using isozymes, cpDNA and ISSR markers) and phenotypic variation of populations of chestnut spanning across the European distribution range will be carried out and included into a common database in order to carry out meta analyses on the structure and distribution of genetic and phenotypic variation of the species.

Comparisons will be made with other forest species. The results on the human impact on chestnut genetic diversity (orchard, coppice, natural); gene flow between wild and domesticated populations; hybridisation and introgression will be included into a common database. Studies on adaptation to major climatic factors carried out in comparative experimental plots will be conducted in chestnut. Carbon isotope discrimination analysis, together with conventional gas exchange analysis, has led to the comprehension of the mechanisms at the leaf level allowing the first large screening for responses at the population and family level. The tuning of this approach led to the achievement of fundamental knowledge on the relationships occurring among phenotypic plasticity of different, but correlated, adaptive traits like delta and growth parameters. The adoption of new isotopic technologies in the investigation of stable isotope ratios of various elements involved across the photosynthetic pathway ( $^{13}\text{C}/^{12}\text{C}$ , D/H,  $^{18}\text{O}/^{16}\text{O}$ ), probably represents an innovative and powerful strategy for a deeper knowledge on both basic adaptive processes and status of forest genetic resources across Europe. Integrated analyses based on multidisciplinary and multiscale studies (genetic, ecophysiological, ecological) carried out in chestnut will allow to identify the major indicators to be included into guidelines related to the conservation and management of chestnut resources as well as to the regulations to seeds and seedling transfer.

(Projects in progress: EVOLTREE (EVOLution of TREEs as drivers of terrestrial biodiversity); CRA-"RISELVITALIA")

Two teams particularly, DIVAPRA – Plant Genetics and Breeding, Piero Belletti, University of Turin, via Leonardo da Vinci 44, 10095 Grugliasco, Italy, and CRA-Issel – Istituto Sperimentale per la Selvicoltura Arezzo, F. Ducci, viale S. Margherita, 80, 52100 Arezzo, Italia, are in tight scientific cooperation for the study of *Fraxinus excelsior*, *Prunus avium*, *Acer campestre* and *Sorbus torminalis*

*Fraxinus excelsior*: Genetic variability and differentiation within the Italian range of the species are analysed by means of molecular markers (nuclear and chloroplastic microsatellites). Genetic data are joined with ecological characteristics of the sampled sites, in order to define Regions of Provenance and to establish a network of Provenance Regions in northern Italy. The latter are a basic aspect for a rational management of activities linked with forest trees propagation, including afforestation and in situ genetic preservation.

*Prunus avium*: The aim of the research is the analysis of seed chain in wild cherry and the evaluation of the effect of ordinary nursery activity on genetic variability of the processed material. The study involves 4 steps of seed production chain: a natural population, two seed orchards made up with different numbers of clones, nursery plantlets and two artificial stands established using plants produced in the nursery. Genetic variability is estimated through the variation scored at nuclear microsatellite loci. The first Italian clones are ready for inscription on the Forest Clone Register. Tests on wood colour and technology traits are ongoing in the framework of two PhD thesis. Continued by ISSA and University of Torino and State Forest Service Seed factories genetic analyses on genetic diversity and on possible biodiversity losses along the nursery system from seed stand to plantations.

*Sorbus torminalis*: Genetic diversity and differentiation of 22 populations from northwestern Italy are investigated by means of variation scored at 53 polymorphic RAPD loci. Populations largely differ in terms of their internal genetic variation. Most of the genetic variation is found within populations, with a significant proportion of variance attributable to genetic differences between regions and between populations. A significant positive correlation is detected between genetic and geographical distances, suggesting that isolation by distance is an ongoing process in the set of populations that were sampled. Selection and intra-population genetic analysis in central Italy carried out by Cra-Issel. Breeding carried out by Univ. of Milano (Prof. D. Bassi).

*Acer* sp. are analysed in DIVAPRA and CRA-ISSEL Institutes

*Acer pseudoplatanus* (DIVAPRA): Genetic diversity and differentiation of 12 native populations of sycamore from north-western Italy are investigated by means of variation detected in polymorphic isozyme systems. The trees show relatively large genetic variability but small interpopulational variation, suggesting the presence of a single gene pool. There is a positive correlation between the

age of the individuals sampled and heterozygosity, suggesting the occurrence of natural selection against homozygotes. No significant correlation is detected between genetic and geographic distances of populations, confirming the lack of any barriers to gene flow.

*Acer campestre* (CRA-ISSEL): is being studied for improvement purposes by CRA-ISSEL and regional forest services. Inventory of genetic resources and selection of Basic Materials is being carried out. A field test network is being established this autumn after the preliminary nursery tests (4 sites in Italy). 11 provenances were sampled in Italy, as well as from Bulgaria, Denmark and Hungary and analysed via allozyme electrophoresis and a multisite field test establishment. A first genetic analysis is being carried out via isozymes in collaboration with Hungary (L. Nagy).

In addition CRA-ISSEL have selected a new populations of Italian alder (*Alnus cordata*) that will be examined experimentally.

*Juglans regia* and its hybrids with *J. nigra*: a population has been selected in the Venice region because hybridogenic, parental relationships and genetic structure of the original populations and of documented off-spring plantations are studying in cooperation with CNR-IBAF, CRA-ISF (Inst. for Fruit Crops) and by Univ. of Budapest (Agnes Major).

(Projects in progress: - Li.ma.b.for. II - Project on Inventory, Database and Selection of basic materials in Tuscany (Arsia, – regione Toscana); - FORGEN – Forest Genetic Resources Conservation and valorization. CRA; - RISGEV – FAO – International Treaty (FAO) for Agriculture Genetic Resources (Italy included unilaterally Forest genetic Resources. Min. of Agriculture and Forestry/FAO; - ProviFOR – Selection, testing and analysing Forest Basic Materials in Campania, Re-establishing a regional nursery system. (Regional Forest Service of Campania); - Riselvitalia 1.1 – Biodiversity and Production of Forest Reproductive materials. (Min. of Agric. and For.); - Riselvitalia 1.1 – Genetic variation of wild cherry for resistance/tolerance to Phytophthora sp.; - MIVAGEF – Breeding and improvement of Forest Germoplasm. CRA;- TreeBreedex – a working model network of tree improvement for competitive, multifunctional and sustainable European forestry. UE-CEC R DG)

## **WORKING GROUP 2 " Management for quality wood production"**

(Responsibles Francesco Pelleri and Michele Brunetti)

In Italy the major problems of the silvicultural management of valuable broadleaved species are concerning the following aspects:

- *Management and valorisation of these species in natural forests.*

In this sector the research is mainly focused on secondary growth ash-maple stands. These are an important new forests typology whose presence is expanding in all the Italian Alps and Prealps; their spreading is connected to the abandon of agricultural and pasture practices in the middle mountain sites which began mainly after the second half of the 20<sup>th</sup> century. These stands are able to produce until 10 m<sup>3</sup> ha<sup>-1</sup> year<sup>-1</sup> and more but at the moment are generally only managed for the production of wood for energy. The activity done has been focused on the study of the forest dynamics in such lands and on testing different cultivation models (traditional system and target trees management system ) more suitable for improving the production of quality timber.

Another new research line recently started is aimed to set up cultivation techniques in order to valorise single valuable broadleaved trees (mainly Sorbus) sporadically present in coppice stands of the Apennines.

- *Development of cultivation techniques in farm forestry plantations.*

These technical aspects started in the meantime with the plantation of more than 100.000 hectares due to the economical support of the EU programs (set aside, 2080/92 and other regulations). Walnut and wild cherry have been the species more planted and studied in Italy. In particular, mixed plantation using valuable broadleaved species, shrubs and nitrogen fixing trees has been set up defining the best cultivation models and techniques for pruning and thinning. Recently new

mixed plantations have been tested using both species cultivated with short (poplar) and long rotations.

From *technological* point of view, the main problems are related to the possible end uses of planted trees and their quality. In this domain we are carrying on studies concerning:

- the valorisation of small and/or low quality timber deriving from thinning, for instance, testing non-conventional uses for locally produced timber;
- the evaluation of the effects of cultivation practices, especially pruning and thinning, on wood quality for timber produced in farm forestry plantations.

Projects in progress: **RISELVITALIA sottoprogetto 2.1** –“Arboricoltura da legno con specie di pregio e cicli produttivi medio lunghi” and **RISELVITALIA ricerca 3.1.8** “Studio e valorizzazione dei boschi e dei cespuglieti di neoformazione originatisi nelle aree agricole abbandonate” financed by MIPAF (2000-2006), “Formulazione di indicazioni tecnico gestionali per interventi selvicolturali su alcune specie forestali sporadiche dei boschi della Toscana” financed by the Tuscany Region - Italy (2005-2006); Euris project "Europeans Using Roundwood Innovatively & Sustainably" - EU Leonardo da Vinci Web site [www.eurisproject.com](http://www.eurisproject.com).

### **WORKING GROUP 3 "Management for non-wood goods and services"**

(Responsible Francesco Ferrini)

During the last two centuries forests and woods in Italy have been managed primarily for timber production. As we move into the 21<sup>st</sup> century there is an increasing interest in the wider resource base contained within forests. These resources include wild edibles, medicines, craft material, which are sometimes referred to non-timber forest products (NTFPs).

Also, when examining forested areas and species composition, man's perception of the surrounding environment is an important factor to consider, as well as his familiarity with it. Not a simple snapshot of the outer world, but an interpretation that involves the senses, the emotional and aesthetic sphere and the cultural situation. This is especially true in forests near urban areas where the significance of recreational value is emphasised.

#### *· Public perception*

In this sector research on the perception of natural spaces has been carried out both in the urban/periurban context and in forest areas at large and there is an increasing interest towards the interaction between natural spaces and people.

Interaction with trees can result in emotional experience and attraction is the common response to forest and wild settings, whereas urban alleys evoke an experience of danger.

Anyway the scenic beauty of the forested landscape affects recreational value since landscape forms the central environment for recreation activities. Aesthetic quality, however, may not be a key factor in all-recreational activities. For example, a clear cut area can have a high recreational value for someone picking berries even though the scenic beauty is not appreciated.

There have been large amounts of empirical research focused on the aesthetic perception of forest Scenery. Much of the aesthetic experience is subjective in nature and has impacts on person's mental and emotional state. Some research projects are now in progress at national level and also involve COST E39 action and some results have already been published (see bibliography).

#### *· Aesthetic values*

A considerable amount of research has sought to operationalise human aesthetic values through systematic studies of preferences and other similar aspects of experience for different types of environments. One central issue in this research has been to find the physical attributes of scenes that result in the variations in preference.

It is known that trees are prominent in theories of environmental perception and landscape aesthetics. This is logical, because trees are an important landscape feature whose form and other characteristics reflect environmental adaptations during the millennia. Some authors attribute the attractiveness of a tree both to its physical form and its symbolic quality. Image of trees are to express values such as permanence, stability, trustworthiness, fertility, and generosity. Therefore theories of aesthetics have been applied to tree form.

Whereas early psychophysical research explored harmonious proportions of parts within geometric figures, such as squares, rectangles, and triangles, studies of tree shape combined the basic laws of proportion and harmony.

People can have a different reaction looking at the different tree forms and forested areas, because different are their backgrounds, their culture, their psychophysical condition, their social state and so on.

This means that it is very important to know what is the answer of the people who will use a newly planned green areas in the urban settings and new forests with respect to the different plants that can be used in such an area.

Some projects on this subject are now running in Italy in cooperation with psychiatrists and psychologists.

· *Biodiversity and habitats*

A national project running since 2004 deals with this subject by monitoring habitat biodiversity in terms of vegetation and animals species. Also the evaluations of the relationship among vegetation/microclimate/environment and among vegetation/pollutants/environment are considered. The urban and periurban green areas have been diversified according to the typology and destination of use. The contribution of such areas in the conservation of the biological diversity within the urban and periurban areas are estimated. The biodiversity associated to the different typologies of green areas is monitored on two different levels of analysis: a first level, at wide scale, regarding the so-called habitat units (UH), intended as homogenous units considering the vegetation and the other factors conditioning the permanence of animal and vegetation species and a second level, at fine scale, regarding animal and vegetation species. Some results have been obtained and papers will soon be published after the end of the project

· *Identification of new non-wood goods and services*

Some products and/or externalities can be provided from the forest resources in order to contribute to the human health and some chemical substances known for their effects on people health are extracted from forest plants. Companies specialized in collecting and workings are present in Italy. Research is in progress in different part of the Country and results have been already obtained by research groups belonging to different research fields (see bibliography).

(Projects in progress: 1<sup>st</sup> European COST E39 Conference, 2005. C. Th. Gallis Ed. October 2005, Thessaloniki, pp. 357; 1<sup>st</sup> European COST E39 WG2 Workshop, 2005. C. Th. Gallis Ed., May 2005. pp. 127.; Project “Research finalized to the estimation of the Ecological and Functional values of standard typologies of urban and pERiurban green areas (REFER)”, funded by the Ministry of University and Scientific Research of Italy November 2004- November 2006.; Project “Research on Multifunctional Green Systems of Tuscany Region (RISVEM)” financed by the Tuscany Region (Italy), 2003-2006)

#### 4.) **Important Literature** Bibliography produced on Scattered Broadleaves

##### **Books:**

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