Workshop on

Biodiversity in Agroecosystems

Milano, 24-25 February 2011

ABSTRACTS

INVITED SPEAKERS

Stella AGOSTINI (Università di Milano)
Governing biodiversities in agri-eco-cultural landscapes

In Italy, 3 milion 663,ooo hectares of soil have been cementified in last decades.
In this sprawl, agricultural lands are progressively erased. In this continuing urbanization process and in its confrontation with the nearby surrounding, in the minds of people agriculture is changing. It is becoming periurban, industrial, urbanized with the risk to be read as a residual area or agricultural emptiness.
Meanwhile the Council of Europe underlines the importance of appreciating and protecting the value of rural heritage, the rich agrarian landscapes, left empty or simplified, become places without any sense .
In this context biodiversity is just another problem to solve.
Any action, for caring biodiversities, landscapes, agriculture or developing infrastructure to facilitate economic growth, requires being inserted into the ecosystem frame and in its capacity to offer services, also cultural, for human well-beings. Landscape and biodiversities are effects of this frame.
Safeguarding them needs over passing approaches of design landscape features.
Connected to governance studies, the research tries to define the framework for improving biodiversity performance in agri-eco-cultural landscapes.

Paul BLACKWELL (University of Sheffield)
Bayesian statistics and modelling in ecology

In ecology, as elsewhere, good decision-making requires not only a thorough understanding of the system studied, but also proper acknowledgement of uncertainty and risk. Bayesian statistics is a framework that allows observations in many forms and from different sources to be combined coherently, incorporating expert opinion where appropriate, making proper allowance for uncertainty in modelling and producing results in probabilistic form that are ideal for prediction, visualisation and decision making.
In this talk, I will give an overview of the Bayesian approach to statistics, and describe some types of model based on random processes, which bridge the gap between conventional statistical modelling and more mechanistic or conceptual models, and which exploit modern computational tools. I will cover a range of applications that relate to biodiversity, varying in scale and scope from radio-tracking of individual animals,

shedding light on interactions between wildlife and agricultural ecosystems, through to the change in range of invasive species and its dependence on the underlying spatial structure of their environment. I will also talk about the measurement of biodiversity itself, looking at how statistics can help understand, for example, the spatial structure and patterns of biodiversity.
I will primarily talk about work in which I have been personally involved, with a number of collaborators in statistics and ecology, but will also illustrate these ideas with other research, including some by colleagues in the UK's National Centre for Statistical Ecology.

Diego BREVIARIO (CNR-IBBA)
Simple molecular tools are available for the rapid characterization of plant wild species.

Biodiversity preservation is a must for the conservation of genetic resources and for the maintenance of a correct environmental equilibrium. A key contribution to plant biodiversity preservation is mainly provided by wild species whose number may be as high as 400.000. Now, despite their important contribution, they do not drive too much attention in the scientific community. Studies on their genomes remain substantially neglected. Often it is not even clear, based on classical botanical studies, where it stands the separation of one species from another. At the same time we are witnessing to a progressive, fearful erosion of these invaluable genetic resources. Nowadays, a global estimate of one in four plant species being under threat of extinction is considered reasonable.
On the other side, modern, expensive, high technology genomic platforms are exclusively dedicated to important crops, denying any relevance to their, even closest, wild relatives. Indeed, one may not want to invest a lot of energy and money on the full genotyping of species such as *Nardus stricta or Luzula campestris* or *Polygonum viviparum*, minor God children. But that is not necessary since molecular genetics can provide flexible tools that can contribute to shed some light on those genomes. Not only these tools are flexible but they are also reliable, simple, handy and very informative. We will present one of such a tool, the name of which is TBP that stands for Tubulin-Based Polymorphism. We have applied such a method to the genotyping of different wild grasses present in pasturelands rather than in the urban areas. A study case on the Phalaris genus will be also presented.
This is a joint work with **Luca Braglia** (CNR-IBBA, Milano)

Anna CAROLI (Dipartimento di Scienze Biomediche e Biotecnologie - Università degli Studi di Brescia)
Livestock biodiversity

Livestock biodiversity is integral to our culture, history, environment, and economy. Thousands of livestock breeds have evolved over time to suit particular environments and farming systems. Conservation of these genetic resources relies on demographic characterization and correct breeding schemes. In addition, molecular genetic studies allow to identify and monitor the genetic diversity within and across breeds and to reconstruct their evolution history. The conservation of livestock variability is also a crucial element in order to preserve and valorise specific nutritional and nutraceutical properties of animal products. Efficient *ex situ* and *in situ* conservation strategies are obligatory tools in order to implement an appropriate action for the conservation of livestock biodiversity. The main issues concerning the different species are summarised, with particular reference to biodiversity still existing in our country.
This is a joint work with **Flavia Pizzi** (CNR-IBBA, Milano)

Paola DE SANTIS (Bioversity International)
Agricultural Biodiversity: promoting adaptive capacity within productions systems

Increases in agricultural productivity over the last 100 years have failed to maintain and account for the important role that ecosystem services play (Millennium Ecosystem Assessment, 2005). Unsustainable agricultural practices have profound, damaging side effects on livelihoods, ecosystem functioning, and in the long□term could depress or reverse productivity gains and increase poverty. A fundamental question emerges on how to ensure that continued agricultural intensification and productivity increases can be achieved in ways that use and enhance ecosystems services more effectively, as measured by increased stability and reduced variability in the agricultural production systems of small scale agriculturalist.
Our research activities aim at developing practices that support communities in their use of genetic diversity to maintain and improve productivity, resilience and resistance in production systems, through enhancing the use of crop genetic diversity to reduce pest and disease damage and crop vulnerability in production systems; determining the linkages between genetic diversity in production systems and ecosystem services; and improving the management of the cultivated/wild interface to enhance farmers use of local crop genetic diversity. As well as understanding and supporting the role of seed systems in maintaining and promoting the continued evolution of available crop genetic diversity in productions systems to empower communities and local institutions to use knowledge and tools effectively to manage and benefit from crop genetic diversity.

Gianni GILIOLI (Dipartimento di Scienze Biomediche e Biotecnologie - Università degli Studi di Brescia)
Invasive specie, biodiversity and ecosystem services

Biological invasions have always been one of most important factor driving the dynamics of ecosystems. With the exponential increase of the worldwide transitions of goods and people problems caused by invasive alien species are assuming proportions never seen before.
After the establishment, invasive species are a component of the biodiversity of the receiving biotic community. However, they often act as agents of disturbance that can profoundly alter structural and functional aspects of the communities.
The evaluation of the impact of invasive species, as well as the prevention and control of invasions are becoming a major priority at global scale. In most of cases evaluation and management of the their impact are limited to the consideration of economic aspects, while less importance is given to the negative effects that these species can have on the biodiversity and thus on the ecosystems.
A framework supporting the comprehensive evaluation of the environmental impact of invasive species is presented. To this aim, in the framework is proposed that in addition to the consideration of the structural aspects of biodiversity, it should also be considered functional aspects that are affected by the invasion. The latter can be usefully described in terms of the impact on the functional traits that are relevant to ecosystem services.

Lisetta GHISELLI (Dipartimento di Scienze delle Produzioni Vegetali, del Suolo e dell'Ambiente Agroforestale, Università di Firenze)
Evaluation of the genetic variability using molecular markers in populations of cultivated species and their utilization in the genetic improvement of the Zolfino bean.

The European bean germplasm, as with the multifaceted bean varieties of Tuscany, manifests a distinctive erosion of genetic variability, mostly due to the "*random drift*" phenomena and selection by man. The present research is aimed at identifying origin

centres of the local European varieties and to characterise the Mesa-American and Andean genotypes and their distribution in order to identify the genetic flow that resulted in the diffusion of *Phaseolus vulgaris* L. in Europe.
SSR molecular markers were used to evaluate the genetic variability in 354 bean accessions: 263 accessions in Europe, 91 accessions derived from domestication centres (Andean and Mesa- American), with the aim of identifying the distribution area of this species. Concomitantly, using SSR markers, the existing variation within and between populations of Zolfino was estimated. Zolfino is registered by ARSIA as a genetic resource of the Tuscany region, that is appreciated for its gastronomic profile both locally and externally. A little more than 20 years ago, Zolfino was at risk of extinction. Even at present, the cultivation of this variety is restricted to a very limited area to that potentially available between the provinces of Arezzo and Florence.
The evaluation of genetic variability using SSR markers in this population in relation to the distribution of different accessions of diverse origins, has permitted both the identification of the origins of Zolfino and the correct assessment of the degree of variation within this accession. The results obtained from this research have also permitted the identification of necessary strategies towards the correct conservation of the germplasm of this variety. In so doing, it will be possible to achieve the following: to increase the genetic variability of this germplasm without altering the identifiable characteristics, to start adequate genetic improvement programs aimed at improving tolerance to biotic and abiotic stress, and to improve production. All of this will permit the attainment of varieties with maximum genetic variability respecting uniformity, productive characteristics and environmental adaptability.
This is a joint work with **Stefano Benedettelli** (Dipartimento di Scienze delle Produzioni Vegetali, del Suolo e dell'Ambiente Agroforestale, Università di Firenze)

Laura LORU (CNR-ISE Sassari)
Agrobiodiversity influence on pests and their natural enemies in agroecosystems

Obviously vegetational diversity strongly influences insect diversity, a fact which is exploited in traditional polyculture farming systems; crop diversity in time and space reduces the incidence of insect pests. On the other hand monoculture farming systems enhance insect pest problems.
Two main hypotheses have been formulated to account for this: natural enemy enhancement and resource concentration.
We analyze here the influence of vegetational diversity in farming systems on beneficial and pest insects, considering both crops and landscape scales, with particular reference to generalist predators.

Luigi MARIANI (Università degli studi di Milano)
Climate change and agriculture

A good point of departure for my speech is the statement of the historian Emmanuel Leroy Ladurie that synthesizes the results of fifty years of original research on the relations between climate and civilization in Europe in the last 1000 years: the civilization can be considered as the system built by the humankind to counteract the dictatorship of the climate. In this general context, a primary role since its birth is played by agriculture, that in a biochemical perspective can be seen as the government of the carbon cycle acted by man.
Agriculture counteracts the always-changing climate by means of the two main tools of genetics (new varieties more adapted to the environment) and agrotechniques (mechanization, fertilizers, phytosanitary products, and so on).
It is well known that the worst periods for agriculture are warm-dry periods or cold periods. Vice-versa warm periods with abundant water resources can be optimal if

adaptation strategies are followed. In this perspective the future is for an intensive, innovative and sustainable agriculture, that will satisfy the needs for food and consumables of humankind (a growth of world population until 9.5 billions of citizens in 2050 is forecasted by demographers) working on optimal climatic belts (that are and reasonably will be mainly located in mid latitudes – climate family C of Koeppen). A further intensification of agriculture, carried out only in suitable areas, is in my opinion the only way to preserve biodiversity in natural ecosystems. By this point of view it is interesting to examine the example of Italy, where in the last 100 years an increase of 70% in the forest area was the result of the gradual intensification of agricultural activity.
The satisfaction of umankind needs of foods and consumables will be attained only if (i) main agricultural areas will be protected against hurbanization, desertification and afforestation, (ii) rational strategies of adaptation will be promoted, (iii) water resources will be improved at a global level (iv) increasing carbon dioxide in the atmosphere will be seen as a resource for agricultural production.
On the base of these presuppositions, this intervention will be finalized to (i) give an overview about variability, trends and breakpoints that characterized the main climatic variables in the last century for the main agricultural belts and (ii) present a brief excursus about the effects on agricultural production of past and present climate, giving also a short and medium range /perspective.

Carlo RONDININI
The role of agroecosystem in wildlife conservation

The increasing anthropogenic pressure on the natural environment, including the conversion into agroecosystems, is causing the ongoing global biodiversity decline. Most species are distributed in the remnant natural areas that are still intact or have not been extensively converted. These are also the areas where most conservation efforts are directed, including the creation of protected areas. Yet it is demonstrated that protecting only intact natural areas is not enough to conserve biodiversity. In addition, the scenarios of socio-economic development (including the most optimistic) predict an increase rather than a decrease of anthropogenic pressure in the next 40 years, with further habitat loss for species. To slow down or reverse the trend of biodiversity decline, it is necessary to conserve it also in impacted areas, including agroecosystems, by applying planning and management methods that allow the coexistence between production activities and the achievement of conservation objectives.

Piero SARDO Slow Food Foundation
Slow food and the protection of threatened biodiversity

Extinction has overtaken evolution. So show the latest scientific studies on the state of biodiversity. This means the planet can no longer compensate for the erosion of biodiversity caused by human attacks on natural systems. Even more serious is the decimation of the agricultural biodiversity created by people over the millennia through domestication and genetic improvement in order to ensure food production. In this case the cutting down of biodiversity is very deliberate, as humans, following a reductionist impulse provoked by the industrialization of farming and fishing, are gradually abandoning less-productive species, varieties and breeds. The picture is increasingly worrying: A domestic breed disappears somewhere in the world every two weeks; since the beginning of the 1900s we have lost 75% of agricultural genetic diversity and today less than 30 plants feed 95% of the world's population.
Slow Food is working hard to protect this threatened biodiversity, with different initiatives on different fronts. It encourages taste education, which is also diversity

education, particularly for the younger generations. It supports food sovereignty in communities, particularly in the Global South, seeking to revitalize local consumption and small-scale agriculture. It does this through the Ark of Taste and Presidia projects, which identify food products at risk of extinction and help their producers to develop their business, to improve quality and to find a fair price. These initiatives can be summed up by the concept of good, clean and fair food, which must be available to everyone, in the north and south of the world. To reach this objective, Slow Food has supported the creation of a global network of food communities, known as Terra Madre.

PROJECT PRESENTATIONS

Riad BALAGHI (INRA, Maroc)
Impacts of Climate Change on Agriculture in Morocco

Climate change is already a reality in Morocco, with recorded changes in both temperature and precipitation. Climate projections on Morocco show gradually increasing aridity because of reduced rainfall and higher temperatures. Climate change will affect both rainfed and irrigated agriculture in Morocco. The warmer climate will increase evapo-transpiration. This could produce yield gains in irrigated vegetable, fruit, and fodder crops, if additional water is made available to cover the increasing irrigation demand. However, water volumes in storage facilities will probably decline, due to lower precipitation and more that proportional reduction in runoff. In general, agricultural yields will remain more or less stable up to 2030, then will drop rather quickly beyond this date, more markedly in the case of scenario A2 than in that of scenario B2. All the agro-ecological zones will not be affected in the same way by climate change. The Favourable and Intermediate agro-ecological zones will be more vulnerable to climate change.
This is a joint work with **R. Gommes, T. El Hairech, D. Rosillon, H. Kanamaru**.

Hamid MAHYOU (INRA, Maroc)
Desertification of Arid Rangelands in Morocco

Rangeland or natural arid pastures of Morocco are ecosystems where there is a natural or semi-natural vegetation composed of steppes, shrubs and grassland. They cover about 82% of the Moroccan arid lands. These areas represent livelihoods for thousands of people and protect the country from desertification. Despite the importance of the rangelands and the threat of desertification, it is surprising that up to date there is no comprehensive assessment of their condition and their evolution, hindering any plan for desertification alleviation. However, the available information on selected pilot areas shows that these rangelands are threatened by desertification. It's associated with biodiversity loss and contributes to climate change. The leading causes of land degradation are the human actions combined with climate. The establishment of a comprehensive surveillance system based on remote sensing, biophysics and socio-economic data must be envisaged to provide policymakers with an operational tool adapted to the spatio-temporal monitoring of desertification.
This is a joint work with **B. Tychon, R. Balaghi, J. Mimouni, R. Paul**

CONTRIBUTED PRESENTATIONS

Lorenzo FATTORINI (Università di Siena)
Sampling strategies for the assessment of ecological diversity

The problem of defining and measuring ecological diversity by means of well-behaved indexes is considered. Any diversity measure is a function of the species abundances in the community, which are usually unknown quantities. Accordingly, the abundances are estimated on the basis of sampling strategies usually adopted when surveys animals and plant communities such as plot sampling, Bitterlich sampling, line-intercept sampling, line- and point-transect sampling. Subsequently, the abundance estimates are used to make inference about the diversity indexes of the whole community. Emphasis is laid particularly on the problem of comparing diversity among several communities. Finally the statistical challenge of estimating species richness is treated together with the related topics of analysing species accumulation curves.

Marco FORNACIARI (Dipartimento di Biologia Applicata – Università degli Studi di Perugia)
Hypothesis of olive cultivation area shifting on the base of climatic scenarios proposed by IPCC

The study of olive flowering have been utilized from several years with different aims such as the olive yield forecasting and in general as bioclimatic indicator: the phenomenon is related to the different environmental variables and particularly to the climatic ones. Moreover, in olive the flowering event with the formation and the successive maturation of the reproductive structures is linked to the different winter colds and the spring heat requirements necessary to define the flower development phases. In the last years many studies have confirmed the close connection between flowering and the chilling units, the growing degree days calculated both in large cultivation areas of the principal Mediterranean countries (Spain, Italy, Portugal, etc) and in the regional cultivation areas (DOP, IGP) characterized by the presence of typical olive cultivars. The flowering historical data from 1999, obtained by a multiregional network in south Italy, demonstrated the presence of “bio-different” behaviours of the cultivars used in the productive olive groves and that the olive cultivation area may shift in the future decades toward the centre Europe abandoning traditional countries such as Tunisia, Morocco, Algeria, according to the climate scenarios of IPCC.
This is a joint work with **F. Orlandi** and **B. Romano** (Dipartimento di Biologia Applicata – Università degli Studi di Perugia)

Marta GIORDANO (Università di Pavia)
Bird species diversity in hybrid poplar plantations in Northern Italy

The negative effects of landscape homogenization and agriculture intensification on biodiversity are well documented. Loss of hedges, non cropped habitats and agricultural practices, such as the increased use of pesticide and inorganic fertilizers, were identified as plausible explanations for the decline of farmland bird populations. To alleviate some of the adverse consequences of agriculture intensification EU introduced agri-environmental measures under the Regulations 2078/92, 2080/92 and later under the Rural Development Regulation 1257/99 and the Regulation 1698/05. These incentives tried to replace part of the widespread arable habitats with non-crop habitats which can provide for several animal needs (e.g. refuges, feeding areas and dispersal corridors). This mosaic of different fields is, a priori, expected to aid species

persistence and biodiversity in general. Unfortunately a lot of these interventions are poorly monitored and their possible positive effects undetected.
During the last decade the set up of hybrid poplar plantation (HPP) for producing biomass has been spreading all over Europe. Beside being an opportunity for an energetic self supply in rural areas, this alternative use of arable land could also lead to a diversification of the agricultural production. In the same way of other arboriculture stands, these plantations could increase the structural diversity in intensively managed farmlands, possibly leading to an increase of animal diversity, In particular birds could obtain benefits during breeding season, thanks to the presence of trees where set nests, and during winter, because they could find a safe shelter in the dense poplar canopy. Several investigations pointed out the positive effects of HPP coppice on animal community of agricultural landscapes, but few studies made comparisons between the diversity of bird community in HPP stands and traditional crops. In Italy the agricultural land-use class dominate landscape. Since 1960s it increased throughout the peninsula, and in particular in the Po river plain. However, in the last decade agro-forestry systems became more common, in particular in the northern part of the Po river plain. As consequence, the presence of HPP has created a mosaic of arable fields and coppices which constitutes an interesting case of study. The possibility that other farmland could be converted to HPP has increased the importance of evaluating how these habitats might affects bird community.
The aim of this work is to investigate the ecological role of HPP in intensively managed agricultural landscapes. The ecological diversity of bird communities in HPP stands, both for breeding and migrant/wintering birds is analysed and compared with those of surrounding habitats, with particular attention to arable habitats.
This is a joint work with **Lorenzo Fattorini** (Università di Siena) and **Alberto Meriggi** (Università di Pavia).

Luisa M. MANICI (C.R.A. – Centro di ricerca per le colture industriali, Bologna, Italy)
Filamentous fungi as indicator of biodiversity loss and soil health of intensively cultivated agro-eco systems.

The agricultural soils of southern Europe countries are affected by progressive loss of soil organic matter (SOM) and desertification problems due to the intensive cultivation and Mediterranean climate conditions. The soil borne fungal pathogen are the main agents of yield decline (called also soil sickness) of the herbaceous and fruit tree crops. The microbial biomass, which is closely related to SOM, and diversity are the main components of soil suppressiveness: the natural ability of soil to control soil borne pathogens. The communities of filamentous soil fungi have been used as soil health indicators in comparative studies within some intensively cultivated areas in Italy. The fungal communities were subjected to similarity and diversity analysis and the findings were associated to the health state of the main crops. The studies showed that the short crop rotations decrease fungal diversity and induce the shift of microbial community composition toward soil borne pathogens specialized to the main cultivated crops.
This is a joint work with **Francesco CAPUTO** (C.R.A - Centro di ricerca per le colture industriali, Bologna, Italy)

Francesca OPSI (CNR-IMAMOTER)
Implication of soil management on biodiversity: a case study from Italian vineyard

Soil biodiversity can be influenced by climate, soil erosion, compaction and management of tillage. As the intensity of the disturbance has an impact on soil communities, biodiversity have mostly been observed in annual crops or grassland

than in perennial crops, such as vineyard. In the “Alto Monferrato” historical region of Piedmont (N-W Italy) an experimental vineyard is available to test the effects of different inter-row soil cultivation techniques on biodiversity. The slope vineyard is composed of three 1221 m2 plots managed with conventional tillage, reduced tillage and controlled grass cover, respectively. They have been monitored since 2000 for climate, soil characteristics, erosion and resistance to compaction. In the near future, sensors connected to an automation system will be installed to allow continuous monitoring of soil moisture and temperature parameters, which can affect the physical and chemical reactions of the soil and the development of microbial biomass.