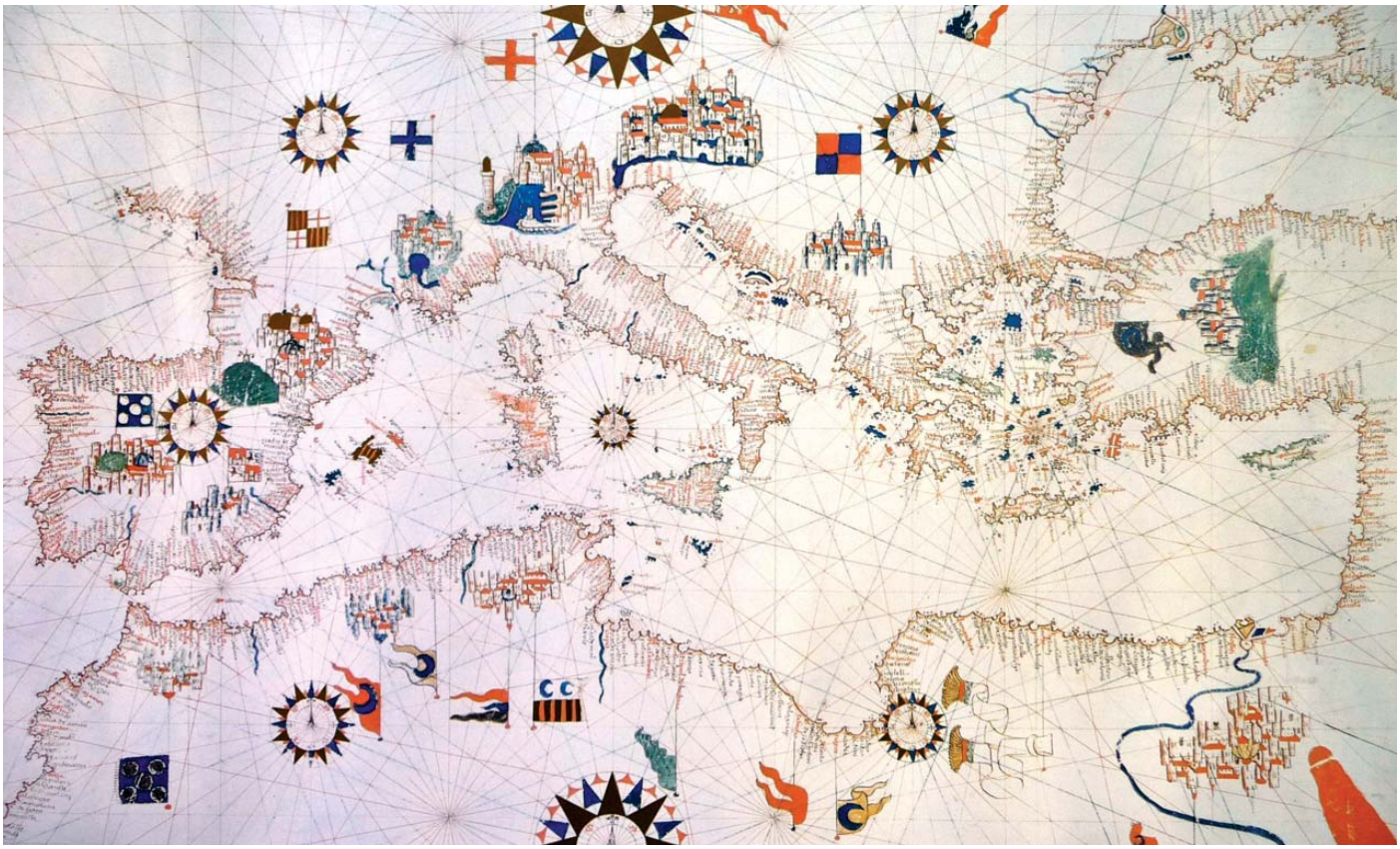


Source: Museo Naval - Madrid (Spain)

Map of the Mediterranean by Mateo Prunes, 1563

PARME Forward-thinking Workshop

PArtnerships and Research in the MEditerranean

The forward-thinking workshop (*Atelier de Réflexion Prospective* - ARP) "*Quelles recherches et quels partenariats pour la Méditerranée?*" [What research and what partnerships for the Mediterranean?] is an initiative of the French national research agency ANR (Agence nationale de la recherche française). Its purpose is to pinpoint research and innovation fields necessitating cooperation between Mediterranean countries and to define the ways such cooperation could be carried through, looking ahead to 2030. What sets this ARP apart is its scope, which is geographic rather than thematic. The areas it covers are many and varied: cultures and civilisations, health, natural resources (in particular water and energy), agriculture and food. The regional approach is germane insofar as the countries bordering the Mediterranean are closely related, both by geography and by history. Their destinies too are linked—economically, socially, culturally and politically.

Thus, what makes PARME a unique project is that it brings all these strands of thought together within the **specific context of the Mediterranean world,** taking **a forward-looking, multidisciplinary and cross-cutting approach.** The region's major future issues have therefore been approached not in a sectoral fashion but according to a holistic vision. Such a vision leads to three broad research fields, pertaining to:

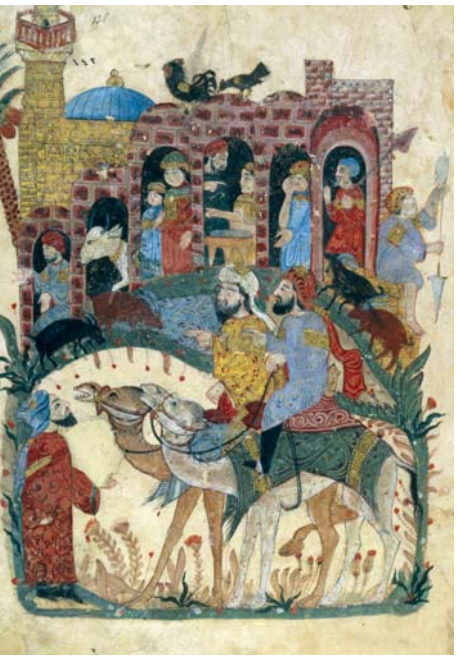
- **men and women, societies and their territories;**
- **natural resources: environments, water, soils and energy;**
- **agriculture, food and health.**

The issues have been thought through with **particular attention to peoples and their territories,** at various scales, from the micro-local to the macro-regional, to promote sustainable development for the region.

A meeting of civilisations*

At the geopolitical level, the Mediterranean basin consists of all countries bordering the Mediterranean sea. From a geographical point of view, the region is bounded on the north by a series of mountain ranges: the Pyrenees on the Iberian peninsula, the Alps on the Italian peninsula, and the Dinaric Alps and Rhodope Mountains in the Balkans. Eastward it includes the peninsula of Anatolia and the Levant, bounded by the Taurus range and the Negev desert. To the south it includes the Maghreb, Libya and Egypt, which are bounded by the Atlas Mountains and the Sahara. This biogeographical complex is characterised by its Mediterranean climate, hot and dry in summer, temperate and wet in winter. It has very characteristic terrestrial and aquatic natural environments, flora and fauna, which make it one of the world's 34 biodiversity hotspots, with an exceptional diversity of endemic species found within ecosystems that are at great risk from global climate change.

Another distinguishing feature of the Mediterranean world is its very ancient human occupancy. Here, agriculture and animal husbandry emerged in the Neolithic; here were born many great empires and rich civilisations beginning in antiquity; and here Western culture began. For millennia the region has played a leading role in the diffusion of knowledge and world trade. As of the seventeenth century, however, the hegemony of the Mediterranean world began to decline, with the development of ocean navigation and the discovery of America. European states then grew much more powerful and the Mediterranean lost its unifying role, becoming instead a cultural and economic divide between the peoples along its shores.



A thirteenth-century miniature depicting everyday life in the mediaeval Arab world

Source: Bibliothèque nationale de France

Today, the Mediterranean world is in the throes of change and facing enormous challenges: people on its southern and eastern margins are experiencing particularly rapid lifestyle changes, linked to economic globalisation and the explosion of communications and transport; they are demanding far-reaching political reforms. In addition, climate change is going to hit the region hard, for there is a strong probability that rainfall will diminish, temperatures will soar and extreme weather events will become more frequent.

These changes are having a profound impact on lands, disrupting traditional frames of reference and spawning new imbalances and weaknesses that will make societies and their environments more vulnerable: unprecedented overuse of natural resources, environmental degradation, increased migration, loss of local knowledge, an explosion of health problems related to changes in dietary patterns and lifestyles... But they may also bring opportunities with them: democratisation of authoritarian regimes, rapprochement among peoples, greater appreciation of territories' uniqueness...

In a forward-looking vision for the next two decades, research, innovation and training have a vital role to play in encouraging these shifts towards a desirable future. If they are to play that role, the national frame of reference must be transcended in order to address issues of concern to the region as a whole, for the destinies of peoples around the Mediterranean are linked. It is also urgent to take a resolutely exploratory approach and to expand societies' capacity for foresight and adaptive management, both in cities and in the countryside.

That is the spirit in which the ARP-PARME Forward-thinking Workshop (What Research and What Partnerships for the Mediterranean?) has been conducted, under the auspices of the French national research agency ANR (Agence nationale de la recherche française) and the coordination of Agropolis International. This paper summarises the discussions held over eighteen months among a hundred and thirty experts in various disciplines from the northern, southern and eastern Mediterranean, which are also set out in the final ARP report. The first outcome of their deliberations was an identification of the major issues that will face the Mediterranean between now and 2030 through the analysis of eighty recent foresight exercises on the region. A further outcome was that experts have defined and refined the research topics they consider essential in addressing these major issues right now.

*The expression is taken from the title of a book by Youssef Courbage, a co-author of this paper, and Emmanuel Todd, *Le Rendez-vous des civilisations*, which focuses on that issue—the very essence of the challenge facing the Mediterranean in the twenty-first century.

Demographics, lifestyles and impacts on political and family structures

In the Mediterranean, every people is now concerned to limit family sizes, to a greater or lesser degree depending on the country. In any event, the "population bomb" problem is a thing of the past. Meanwhile, average life spans are increasing, resulting in an aging population and the coexistence of several generations.

These demographic changes, coupled with profound lifestyle changes and the advent of the information and communications society, have marked effects on family structures, social relations, traditional ties of solidarity and, finally, on political structures and modes of governance. The effect of these changes is to challenge the traditional North/South divide and blur the lines between cultures, suggesting that within a few decades there will be demographic, sociological and political convergence within the Mediterranean basin. Despite that convergence, a number of differences are bound to crop up because of local situations. **In order to understand and support this changing world, research will focus both on major trends and on contrasts between countries but also, among the peoples of each country, by territory and by social class.**

RESEARCH FIELDS

- Demographic trends
- Gender relations, family, procreation
- Family ties and relations between generations
- Family and social policies
- Forms of social and political civic engagement
- Emergence of new political and intellectual elites
- Exercise of power in times of uncertainty and change
- Political patterns, interests and economic behaviours

On the left & on the right: © D. Lacroix, IFREMER / In the middle: © O. Barrière, IRD





International mobility, at the heart of the changes in contemporary society

Population movements have always existed throughout the world, especially in the Mediterranean world, and have led to economic, social and commercial changes and exchanges, but also to conflict. The unprecedented expansion of communications and transport is now a prominent feature of the second great transformation of global society—after the Industrial Revolution—as is the circulation of knowledge, goods, technology and capital. Population shifts are not only ever more numerous, at different scales of time and space, but their motivations are increasingly diverse.

Migration is still too often discussed only in demographic and economic terms, which do not come to grips with the real issues in contemporary society. Essential roles are played, in that connection, by self-actualisation, the desire for emancipation in one's personal and professional life, back-and-forth migration and maintenance of a link to the diaspora. **Thus, research on this topic should analyse migration as a "total political fact" and should proceed by involving researchers from sending countries—to study emigrants' profiles and motivations—and from receiving countries, to understand immigrants' social and professional integration, according to the host countries' immigration policies and practices.**

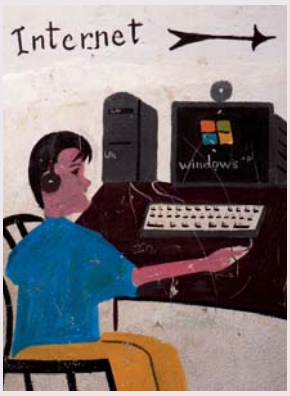
RESEARCH FIELDS

- Analysis of migrants' motivations from a historical perspective
- Effects and evaluation of migration policies at the Mediterranean and European levels
- Significance of unstable mobility and back-and-forth migration within migratory movements
- Outcomes and impacts of migration in sending countries

Cultures, identities, religions, values: civilisational interactions in the Mediterranean

RESEARCH FIELDS

- Evolution of religious references, values and representations in a context of democratic transition
- Public impact of societies' religious pluralisation
- Changing social and economic forms of religion
- Construction of new spaces for communication and mobilisation
- Dissemination of new cultural and artistic models
- Analysis of past practices at the political, economic and social levels



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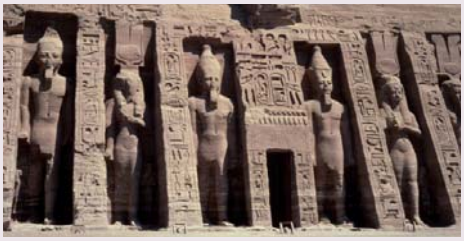
In early 2011, the "Arab spring" uprisings showed the whole world what profound changes were taking place in Arab societies: secularisation, desire for democracy, increasing role of women in politics... These long-term changes had previously been masked by a vision of the Mediterranean world that was in thrall to the "clash of civilisations" theory, wherein the Islamic world was seen as viscerally inimical to the Western world. Introduced by the English orientalist Bernard Lewis and popularised by the American political scientist Samuel Huntington in the 90's, that theory was supported by the often tragic news from some Muslim countries, which were dealing with the rise of religious fundamentalist movements and hard-line authoritarian regimes.

Many dissenting voices were raised within the social sciences community, highlighting the processes of hybridisation and cross-cultural interaction in the Mediterranean world, which constitutes a sphere apart in the globalisation movement. The challenge for sociological and anthropological research is to map the new contours of these changing lands. **How will religious practices evolve? What modus vivendi might be arrived at between the great religions? At what levels will values and representations converge or diverge? What new horizons will emerge for cultural references and identity? What will their means of production and expression be? How will peoples draw on the past in response to the social, political or economic needs of the present?**

Tourism: tensions versus opportunities in the use of goods, services and land uses

RESEARCH FIELDS

- Study of archaeological, historical and artistic heritage in the light of territories' development and local knowledge
- Cultural heritage and formation of national and regional identities
- Forms of physical and visual experience of the past, revitalisation of traditions
- Creation of tourist areas and implications for resource management and allocation and for territorial development
- Goodness of fit and/or conflict with local activities and social structures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The Mediterranean, whether to the north or the south, with its 46,000 km of coastline and a warm, dry summer climate, is a biogeographical and cultural hub with great attractions for tourists: over 200 million visitors a year (a third of the world's total tourist trade). And, like other forms of mobility, tourism is gathering strength. Projections are for an increase to upwards of 150 million in the number of visitors to the Mediterranean by 2030.

Such an influx of people, often concentrated in space and time, though it does contribute to regional economic development, is problematic in so fragile an environment. Some forms of tourism have far-reaching consequences in terms of degradation of cultural assets and landscapes; resource use (water, land, energy, etc.); pollution and greenhouse gas emissions; and destabilisation of societies and local activities... **Hence, it is essential to conduct a multidisciplinary examination of the issue that relates general tourism flows to heritage, land use and resource management policies. In particular, the mobilisation of ICTs and the development of hinterlands should help to better allocate and manage the pressure and economic benefits of tourism.**

Urban and rural areas: new vulnerabilities, new complementarities and governance issues


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The mobility observed at the international level constitutes only part of the population movements that are affecting territories and reconfiguring national space into a mosaic of mushroom cities and rural areas that are constantly losing population. This spatial split, which is at once the result of profound lifestyle changes and a reflection of economic and social polarisation, is a threat to the world's economic efficiency, limiting opportunities for national growth. Out-of-control urbanisation aggravates risks (natural disasters, supply disruptions, conflicts...) and brings about greater pollution, waste, and social segregation. Rural areas are marginalised and fall prey to ills that eventually cause an explosion. In periurban areas, the emergence of mixed spaces combining low-grade, precarious urbanisation, farmland and natural areas, puts increased pressure on natural resources and aggravates management difficulties. Improved transport and communications nevertheless make for new complementarities between rural and urban areas, promoting the emergence of new activities in rural areas.

In this context, it is essential to better understand the territorial dynamics at play, their determinants and their economic, social and environmental consequences, with the aim of proposing policies and governance arrangements that can reduce territories' vulnerability and enhance their complementarities. In particular, research on governance should aim to facilitate a territorial rather than sectoral approach to public policy, in order to link cities and their hinterland, to bring together the various stakeholders and land users, to take heed of access to resources (water, agricultural production, etc.) and the mitigation of natural (seismic, volcanic) and environmental (floods, fires, landslides, etc.) hazards, and to ensure that land issues are addressed.

RESEARCH FIELDS

- Mobility, lifestyles and territorial restructuring
- Recomposition of hinterlands, emergence of new interface areas and new rural-urban complementarities
- Land dynamics and social and territorial reconfigurations
- Effectiveness of different land management methods
- Vulnerability of metropolitan areas and dynamics of urban social interactions
- Territorial intelligence and urban and territorial governance


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The coast: a coveted interface zone where impacts are concentrated


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In 2000, a third of the 430 million inhabitants of countries bordering the Mediterranean were living in coastal areas. That concentration of population at the coastline is increasing, especially in the countries of the southern and eastern Mediterranean, due to population growth and the migration of rural populations to the large coastal cities. The creation of man-made landscapes, resource depletion (water, land) and the resulting pollution generate conflicts of use and increasingly degrade natural environments. Upstream of the coastal area, such facilities as dams or irrigation canals and the drawdown of water along river systems limit freshwater flows downstream. These facilities not only lead to hypersalinisation and loss of productivity of lagoon environments—ecosystems with great heritage value that underpin major economic and social activities (fishing, aquaculture, shellfish...)—but also reduce the deposition of sediment, thus impacting the evolution of the coastline, already threatened by the predicted rise in sea level.

Implementation of integrated and effective management of coastal areas requires a better understanding of coastal anthropo-ecosystems and upstream water systems, and the interactions between flows of water, minerals, biological resources and pollutants. These studies should be based on a network of "workshop areas" occupying different geographical and sociopolitical contexts, equipped with devices for long-term observation and pursuing multidisciplinary and multi-scale research goals, involving scientists and managers, including the State and local communities.

RESEARCH FIELDS

- Functioning of coastal anthropo-ecosystems
- Water needs for aquatic ecosystems to function
- Interactions between flows of water, minerals, biological resources, pollutants
- Development of tools for integrated management of coastal areas

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Preserving Mediterranean ecosystems, long-anthropised environments

RESEARCH FIELDS

- Functioning, adaptation and resilience of ecosystems; dynamics of genetic diversity
- Response of riparian ecosystems to more severe episodes of drought and flood
- Integrated observation service and relevant biodiversity indicators at different organisational levels
- Heritage-based approaches to asset management and environmental services
- Comparative analysis of policies and strategies for management of natural environments and biodiversity
- Development of modelling tools for understanding and integrated management of Mediterranean anthropo-ecosystems
- Design of innovative agricultural production and animal husbandry systems
- Characterisation of fire regimes, modelling of fire propagation across the landscape, detection and warning systems

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Located at the intersection of tropical, arid and temperate influences, the Mediterranean region is a unique biogeographical entity, considered one of the 34 hotspots of global biodiversity. Its rich and varied natural environments show high rates of endemism. Because of its three millennia of permanent human occupancy, it has also seen many novel types of interaction between human societies and their environments. But these anthropo-ecosystems are particularly threatened as the region is being quickly and deeply affected by global changes.

In order to maintain all functions, goods and services provided by these socio-ecological systems to the societies that depend on them, an adaptive management approach is needed, based at once on the development of new fundamental knowledge, on action research involving scientists, managers, policy makers and local people, and the ongoing melding of available knowledge into operational tools to explore new ways of management. **Research must seek a better understanding of species' and communities' adaptive and evolutionary processes, as well as the structural and functional aspects of biodiversity. Environmental management and development systems must take heed of the multiplicity of users, by means of mediation devices, but also taking into account natural hazards (fires, floods, etc.).** Given how long human actions have affected all Mediterranean ecosystems, arguments on environmental management must take full account of agricultural production and animal husbandry practices.

Improving the management of water, a critical resource

RESEARCH FIELDS

- Surface hydrological processes
- Hydrological processes in karstic and sedimentary aquifers
- Process modelling and coupling of models for an entire watershed
- Strategies for sustainable and integrated management of water in the territories (treatment, recycling, transport...)
- Total efficiency index of water and its sectoral components
- Wastewater reuse
- Technical and economic efficiency of irrigation
- Linkage of the various scales of governance and resource allocation for national watersheds
- Cross-border water management: institutions, international relations, decision support tools

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The Mediterranean climate is characterised by sparse rainfall (less than 100 days a year) that is unevenly distributed over time (long periods of summer drought) and sometimes quite weak (about 300 to 500 mm per year in some semi-arid regions). Most countries in the region face problems of overuse of water resources: mobilisation of surface water by waterworks and groundwater pumping have lowered water tables, brought about changes in hydrologic regimes and disturbed aquatic ecosystems downstream from river systems. In addition, poor management of agricultural inputs has led to a deterioration of water quality in watersheds and aquifers.

Water is a scarce and coveted resource in the Mediterranean, and will be even more so in the future. Indeed, most climate change scenarios for the region call for decreased rainfall and higher temperatures, while the population will continue to increase until 2030. **It is essential, therefore, to begin today to design new ways of water management, to ensure greater equity and efficiency of resource use and to monitor its impact on ecosystems, soils and societies at different levels of organisation.** For an effective management of water flow and quality, what is needed is, on the one hand, observations of surface water and groundwater at different scales and, on the other hand, appropriate models for understanding the process, stakeholders' behaviour and the impact of management practices on resources.

Maintain soil potential

The preservation of fertile soils is a crucial issue, especially in the Mediterranean, where the availability of arable land is restricted by topography and where agricultural production is limited by the uneven distribution of rainfall. Degradation of plant cover exposes the soil to erosion and runoff, the first step towards desertification. Improper irrigation management can lead to soil salinisation, making the soil unfit for cultivation, just as poor farming practices can lead to loss of fertility of agricultural land.

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In contrast, well-maintained soil will be better able to retain rainwater and nutrients for crops to take up. The soil is also where pollutants are processed, filtered, purified and re-released. Finally, the soil can play a significant role in sequestering or, contrariwise, releasing carbon dioxide. Hence, soil, water and vegetation need to be viewed as a whole. **Research should focus on the role of soils, plant cover and the way the soils are managed in regulating water resources, and develop farming methods conducive to optimising the amount of water available to plants ("green water"). It should also explore the mechanisms of soil erosion at different spatial and temporal scales. Soil microbiology and mineral nutrient cycles are also important areas for investigation. Finally, research must incorporate traditional knowledge of land management and develop environmental engineering techniques for the remediation of degraded soils.**

RESEARCH FIELDS

- Mechanistic approaches to the soil/water/vegetation continuum
- Water cycle modelling at different spatial and temporal scales
- Effect of global changes on soil structure and capacity
- Soil biological activity
- Methods for measuring soil hydraulic properties
- Concepts and methods of evaluation of soil functions
- Land and plant management methods for the optimisation of "green water"
- Remediation of degraded soils
- Knowledge of traditional soil conservation systems

What energy security for the region in 2030?

At present, 80% of the region's energy supply is derived from fossil fuels, and northern Mediterranean countries account for two thirds of the region's greenhouse gas emissions. In 2030, if present trends continue, the increase in population of Mediterranean countries, together with urbanisation and economic development in the South and East, will generate strong growth in energy consumption. Hence, controlling energy demand and improving supply management, while focusing on renewable energy, are major issues in the context of climate change. In terms of demand, research efforts should focus both on the determinants of people's energy footprint—taking into account cultural, social, political and economic aspects—and on sectoral governance. A better understanding of all these points will be useful in defining effective public policies to promote energy savings, with due regard to public awareness and to financial and regulatory incentives, converging at the regional level.

In terms of supply, the Mediterranean basin has great potential for developing renewable energy, including solar, geothermal and ocean energy, which should receive priority in building regional energy security. This should be based on a coordinated assessment of the complementarity of energy resources across territories and an analysis of the various energy production processes, taking into account their technological, environmental, political, economic and social aspects. **The ratio of energy supply to demand must be thought through at various scales, while a mix of energies needs to be promoted at the local level, using locally available resources. Technological innovations are needed to facilitate the safe transportation, storage, networking, coupling and recycling of energy.**

RESEARCH FIELDS

- Energy governance
- Peoples' energy footprint
- Energy savings incentives
- Inventory and complementarity of resources
- Comparative analysis of energy production processes
- Spatiotemporal analysis of the relationship between energy supply and demand
- Decision support tools for supply and demand management
- Renewable energy technologies
- Technologies for the transportation, delivering, storage and recycling of energy

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A "Sustainable Mediterranean Building" certificate for reduced energy consumption

RESEARCH FIELDS

- Salvage of traditional knowledge in the field of Mediterranean bioclimatic architecture
- Optimisation of exchanges between the built environment, the atmosphere and the subsoil
- Cold production and heat removal systems for air conditioning
- Storage of heat and cold for recovery at different time scales (heating and cooling needs)
- Direct use of renewable energy (without conversion to electricity)
- Analysis of political, regulatory, economic and financial issues
- Public policy support tools

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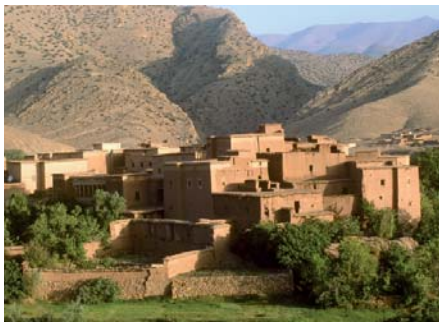

In the South and East of the Mediterranean, population growth and urbanisation generate a significant need for urban housing. By 2030 some 42 million new dwellings should be added to the 66 million that now exist (2007 figures). However, the construction industry alone accounts for nearly 40% of final energy consumption in these countries. That is potentially a powerful lever for limiting the increase in energy demand, with energy savings of up to 60% for an additional construction cost of only 10 to 25%.

Action in that sector will also affect both demand (through energy efficiency) and supply (through the integration of renewable energy). To achieve that, buildings must be rethought in toto, within their national context, taking into account traditional knowledge based on bioclimatic principles, existing technologies, and innovation. Development of a large-scale green building market currently faces hurdles that are informational, economic, organisational and technical in nature. **Research should focus on ways and means to overcome those hurdles by helping with the technological conceptualisation of a "sustainable Mediterranean building" and the development of tools to support public policy in aid of the organisation, financing and training of stakeholders in the sector. The creation of pilot centres and sustainable Mediterranean building programmes could play a significant role in the dissemination of this concept.**

What trade-offs between water and energy?

RESEARCH FIELDS

- Water-energy interactions
- Management scales and technical choices linking water and energy
- Joint analysis of water and energy services in urban policies
- Environmental value of desalination, energy efficiency and use of brine
- Dry cooling for solar power plants

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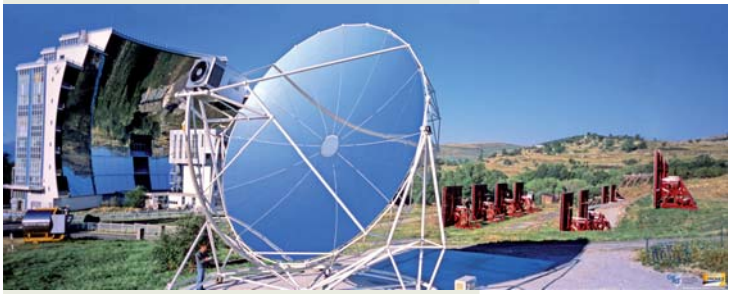

The links between water and energy are particularly strong and problematic in the Mediterranean. On the one hand, water mobilisation, transport and use consumes energy: to pump surface water or groundwater for water supply, to treat drinking water and wastewater, and to desalinate seawater. Given the increasing demand for the resource and its scarcity, water-related energy needs are increasing rapidly in the southern and eastern Mediterranean. Conversely, energy production also consumes large amounts of water: for hydroelectric power generation on the one hand, and to cool thermal or nuclear power plants, on the other. These uses of water in energy production have environmental impacts, particularly in situations of drought and high temperatures: failure to maintain a minimum low flow in rivers, thermal pollution due to the discharge of hot water into rivers.

In this context, and more so in the Mediterranean than elsewhere, the interactions between water and energy, as well as the political implications and the technical choices linking the two sectors, need to be better understood and quantified. In addition, the development of certain types of renewable energy in arid areas, including concentrating solar power plants, is impeded by the need for water for cooling. **Hence, the development of dry cooling techniques is an important avenue for research.** Finally, the region's countries are increasingly resorting to desalination of seawater to meet water demand and forestall any shortage, but at a high cost in energy and environmental terms (brine discharge). **In addition to analysing the value of desalination relative to other alternatives, research efforts should focus on reducing the technology's environmental footprint.**

Ensure quantitative and qualitative regional food security

Agricultural production in the Mediterranean basin is severely constrained by limited availability of water and arable land. This situation is exacerbated in the South and East of the basin by the structural, technical and economic weakness of stakeholders in the agricultural and agri-food sector. Thus, the North Africa/Middle East region is one of the worst off in terms of per capita food availability, a situation likely to worsen by 2030 due to growing demand for food and dwindling resources. Imports can certainly compensate for a lack of production, but at the cost of high dependency on the international market, with all the concomitant risks that have been evidenced by the recent food crises. In addition, imports are facilitated by food subsidy policies intended to ensure low prices for urbanites—hardly an incentive for small farmers to break into the local market.

Qualitatively, the situation is even more worrying with the explosion of chronic food-related diseases throughout the basin—a striking paradox in a region that prides itself on developing a diet recognised for its health benefits. Finally, in the absence of any health monitoring network, and because the large informal sector operates outside any standards and controls, food security problems are recurrent in the South and East of the basin. **To ensure quantitative and qualitative regional food security, ambitious agricultural policies need to be designed based on local resources, taking advantage of the diversity and complementarity of the territories and incorporating qualitative aspects.** At the national level, the challenge is to reconcile increased production, environmental protection and regional development while involving rural stakeholders. Sustainability and quality standards must be defined throughout the sectors, with capacity building for stakeholders at all levels. **At the regional level, a cooperation policy dealing with every aspect—human (training), commercial (trade enhancement), financial (investment) and regulatory (environmental, nutritional and health standards)—would ensure greater collective stability, benefiting the entire region.**

RESEARCH FIELDS

- Dynamic of changing food demand, in quantitative and qualitative terms
- Economic and regulatory tools to monitor production systems and reorient them toward more environment- and worker-friendly modes
- Public policies to encourage the adoption of innovations and food industry development
- Public food and health policies
- Creation of safety, monitoring and health control systems
- Regulatory mechanisms to promote regional cooperation around the Mediterranean
- Instruments to support a Euro-Mediterranean food codevelopment policy

Designing of innovative production systems suited to global changes

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Mediterranean agriculture, being deeply rooted in specific communities and rural areas, is particularly sensitive to global changes. On the one hand, climate change could exacerbate the characteristics of Mediterranean climate (low rainfall and high summer temperatures) and the frequency of extreme weather events (heat waves, late frosts, droughts, torrential rain). On the other hand, economic, industrial and financial globalisation threatens to break down societal patterns that are themselves rapidly changing. Thus, the major challenges are to characterise the diversity and dynamics of the various types of Mediterranean agriculture and to take advantage of their specific features while adapting them to changing conditions.

What is needed is a "new" agronomy, taking into account local knowledge and based on the control of agro-ecological processes, the development of water-efficient cropping systems and the use of the spontaneous and domesticated biodiversity of the Mediterranean. Again, farmers' practices and the socioeconomic and regulatory processes by which they are framed and constrained need to be analysed, understood and guided. The objectives are at once an increase in agricultural production, the provision of various environmental services, the maintenance of complementary income-earning activities in rural areas, and a contribution to development and spatial planning. Achieving these goals calls for the implementation of new participatory collective design approaches and the use of tools such as simulation of complex systems, multi-criteria analysis, etc.

RESEARCH FIELDS

- Characterisation and analysis of technical, spatial and organisational dynamics of Mediterranean production systems
- Improvement of the productivity of rainfed farming and rangelands, crop-livestock farming systems
- Optimisation of water efficiency in rainfed and irrigated cropping systems
- Development of participatory design approaches
- Multi-criteria evaluation tools for agricultural practices and cropping systems
- Understanding of how plants adapt to environmental constraints
- Taking advantage of spontaneous and domesticated biodiversity in Mediterranean agricultural and animal husbandry systems

Control pathogens of plants and animals and their vectors

RESEARCH FIELDS

- Factors in pest emergence
- Diversity, evolutionary biology and phylogeography of pathogen populations and their vectors in the Mediterranean
- Bioecology, capabilities and physiopathology of Mediterranean vectors and pathogens
- Epidemiological dynamic and modelling of animal and plant diseases
- Integrated management of plant and animal health, better use of pesticides
- Design of agricultural and animal husbandry systems to better control pathogens; role of biodiversity
- Identification of resistance genes
- Implementation of permanent watch systems and health monitoring at the regional level


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The Mediterranean is a hotspot not just for biodiversity but also for the emergence of animal and plant diseases. The fragility of its ecosystems, the flows and concentrations of human and animal populations, the proximity of humans and animals, the uncontrolled use of antibiotics and antiparasitic products, difficulties in implementing effective health inspections, and the effects of climate change are all factors that favour the persistence of pandemic animal diseases, the resurgence of epidemics and the emergence of new pathogens. Not only does this pose a threat to human health, it also constitutes a major constraint on efficient agricultural, zootechnical and economic practices in agricultural and animal husbandry systems in the region.

The issue of animal health must be addressed both in terms of factors for the emergence of new pathogens and vectors and in terms of integrated management of zoonoses. Plant diseases and pests also cause significant losses in cereal crops and vegetables. **The issue of regional food security also requires a more effective fight against plant pests through the identification of plants' resistance genes and better management of cropping systems to limit the spread of diseases, the development of resistance by pathogens, and loss of effectiveness of pesticide treatments.** In particular, biological diversity plays an important role in controlling animal and plant pests, as regards both the temporal (crop succession) and the spatial dimension at various organisational levels (from plot to whole landscape).

Promote integration of smallholdings into formal supply chains

RESEARCH FIELDS

- Standards, logistical infrastructures, organisational forms, public policies and innovations in the banking and credit system to promote the integration of smallholdings and SMEs into modern distribution channels


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- Reduction of post-harvest losses
- Enhancement of regional products as a lever of territorial development
- Function of periurban agriculture in supplying cities
- Health quality of food from smallholdings and informal channels

Faced with a saturated Western market, the multinationals of the agro-industrial and agro-service sector (retail, foodservice), in search of new growth opportunities, are targeting developing countries. Suppliers of these downstream firms must meet longer payment deadlines and rigorous standards of quality, traceability and product homogeneity, on the one hand, and supply regularity, on the other hand. In the southern and eastern Mediterranean, however, upstream suppliers are usually widely dispersed, creating logistical difficulties in gathering raw materials (with significant post-harvest losses) and assessing their quality. To meet retail or food industry requirements, local operators must reorganise, leading to a concentration of production and processing, as smallholdings and small businesses have very great difficulty in gaining access to commercial channels.

These small, low-cost entities nevertheless produce a high proportion of staple foods (milk, meat, fruits and vegetables, cereals), often with unique qualities derived from local know-how and skills ("products of origin"). In addition, they create rural employment and provide environmental services. However, most of these small companies operate in an informal setting, with very unclear distribution of margins between producers, intermediaries, middlemen and distributors, and with recurrent food safety problems. **The integration of small producers into formal supply channels is a major challenge for research on agri-food supply chains: the role of public and private standards, logistical infrastructure and public policies in promoting such integration will have to be looked at. Particular attention should be paid to maintaining the diversity of regional products and their economic use as a lever of territorial development, and to preserving periurban agriculture, which plays an important role in supplying cities with fresh food.**

Support the development of food industries suited to local conditions

Consumption of Mediterranean foods, usually prepared at home or in crafts setting, is giving ground to fast food, subject to modern distribution models and often made from imported and subsidised raw materials. This not only contributes to unbalanced nutrition, a source of significant health problems, but it also causes a decrease in agricultural activities and accelerates rural exodus and urbanisation and increases the market share of imported products. It also hinders the development of local food industries, which generate employment and add value.

In this context, supporting competitive and innovative businesses, able to promote local products while proposing consumption models adapted to changing lifestyles, is a major issue for sustainable development in the Mediterranean region. **Hence, food industry research faces a threefold challenge: technological innovation in the industrial development of traditional products, nutritional and health quality of processed foods, and competitiveness of local products vis-à-vis imports.** Progress in these areas will only be possible with the support of proactive policies linking regional development, use of local production and promotion of a healthy diet.

RESEARCH FIELDS

- Technological analysis of traditional food systems
- Characterisation of functional and nutritional properties of Mediterranean food commodities
- Development of technological processes that are more efficient as regards energy, environment, nutrition and health, based on reverse engineering approaches
- Improved flexibility of production lines to accommodate the variability of raw materials
- Improved economic viability of processing methods through the enhancement of co-products, waste reduction, and market differentiation

Explore the links between population, food, lifestyle and health

In all Mediterranean countries, food security seems assured for now in quantitative terms, as less than 5% of the population is in a chronic malnourished state (in terms of energy). However, when it comes to food quality, not only are there still certain micronutrient deficiencies with relatively high prevalence on the southern and eastern shores, particularly affecting women, but especially there is a massive emergence of diet- and lifestyle-related chronic diseases (heart disease, cancer, chronic respiratory disease and diabetes). These diseases have become the leading cause of death both in the North and the South. While the traditional Mediterranean diet is considered particularly healthy, the Mediterranean is paradoxically one of the areas of the world where overweight and obesity are most prevalent—a clear sign of dietary shifts in progress: excess consumption of carbohydrates, sugars, saturated fat and salt, lower consumption of fruits, vegetables and fibre.

These changes are largely correlated with the growth of retail and industrial products. The human, social and economic costs of the epidemic of metabolic diseases are enormous, but policymakers have not always taken their measure. **The challenges of research in this area are considerable: first, the complex relationship between diet and health in the Mediterranean context needs to be understood, taking heed of genetic, epigenetic and behavioural determinants of chronic disease.** On the other hand, we must better understand eating habits, their heterogeneity and their determinants. These two research streams require monitoring of cohorts throughout the Mediterranean region to gather epidemiological data on chronic diseases and monitor their advance. This data will feed into discussions on care and prevention strategies and policies suited to the various contexts and populations around the Mediterranean.

RESEARCH FIELDS

- Nutrigenomics studies to identify the genetic features of Mediterranean populations in terms of physiological responses to food
- Diet of pregnant women and infants: effects on foetal programming, epigenetic modifications, physiological development of young children
- Relationship between micronutrient deficiencies and chronic diseases
- Constitution and monitoring of cohorts for the observation, analysis and understanding of the evolution of food behaviours and their determinants
- Reflections on support and prevention policies in the Mediterranean context

Organisation and operation of ARP-PARME



Structure

A **steering and orientation committee** (CPO) made up of 15 members:
- Agropolis International, project coordinator, under the chairmanship of Bernard Hubert
- 8 French institutions of research and higher education: Agreenium, BRGM, Cemagref, IFREMER, INSERM, IRD, PRES *Universités de Montpellier Sud de France, Université de Corse*
- 6 international entities: Arim-Net, Ciheam, Inter-academic Group for Development, Groupe Futuribles, Plan Bleu, EuroMed Innovation Network.

A **working group to summarise the still available forward-looking studies** (CSEP): a multidisciplinary group comprising 30 experts.

A **cross-cutting experts' group** (GET) consisting of 28 members with expertise in different fields of study, which is responsible for the interface between the CPO and the thematic working groups.

Four **thematic working groups** (GTTs), each consisting of from 17 to 33 experts in the following areas:
- Cultures and societies
- Territories and resources
- Energy
- Agriculture, food and health

How it works

Fifteen thematic, cross-cutting or steering workshops over **18 months** (January 2010-June 2011), organised in **4 phases**:
- Phase 1: synthesis of existing forward-looking studies
- Phase 2: development of a common forward-thinking framework by the GET and set-up of GTTs
- Phase 3: identification of research priorities within each GTT
- Phase 4: cross-cutting analysis by the GET of the 4 GTTs' proposals and structuring of the final report; approval by the CPO.

More than **130 experts mobilised** (including thirty from the southern and eastern Mediterranean countries) in **all disciplines** (agronomy, energy, environment, geography, social sciences), from about **sixty organisations** in **ten countries.**

A **final report of 200 pages and 78 foresight studies fact sheets**, available on the website **www.agropolis.fr/arp-parme**

Links to other initiatives on the Mediterranean:
- European ARIM-NET programme for coordination of Mediterranean countries' agricultural research
- International MISTRALS programme (Mediterranean Integrated Studies at Regional and Local Scales)
- ARP Futouraumed (alternate futures for tourism in the Mediterranean) coordinated by the EuroMed Innovation Network
- EFIMED, Mediterranean Regional Office of the European Institute of Forestry.

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