ResAlliance

Landscape resilience knowledge alliance for agriculture and forestry in the mediterranean basin

Report on needs, barriers, gaps and solutions for landscape resilience implementation in the forest and agriculture sectors

Deliverable 2.3

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1 Introduction

The ResAlliance project aims to provide foresters and farmers with the knowledge and tools necessary to implement innovative landscape resilience solutions. As described by the project, landscape resilience is defined as the ability of a landscape to sustain its range of natural and human-related functions and processes over time under changing conditions, despite multiple stressors and uncertainties. For this, the project gathers and assess knowledge, gaps, barriers, and good practices to achieve resilient landscapes in the Mediterranean basin. This report is part of the ResAlliance deliverables and summarizes the results of a public survey launched to identify and understand the principal needs, barriers, bottlenecks, innovation, and knowledge gaps to achieve resilient agriculture and forestry to socioeconomic and climate changes.

The contents of this document are organized in 4 chapters. First, an identification of the general and specific objectives of the survey is done in chapter 2.1, followed by the concrete explanation about how the survey was designed, spread, conducted, and assessed (chapter 2.2). Chapter 2.3 displays the general results of the survey, providing information on the profile, site and sector of activity of the respondents. Second, a central chapter comprises the analysis of the survey results, organized in two sections to facilitate comprehension. The first section aims to identify “resilience to what”, and the third topic is identifying the main useful and missing practices. Second, a chapter on how to reinforce resilience is showing the main conclusions of the assessment. Finally, a chapter on final remarks is highlighting the main key ideas resulting from the whole identification and analysis process.

2 Objective and methodology

2.1 Objective

The **main objective** of the survey is to assess and comprehend the primary needs, barriers, gaps, and potential solutions faced by stakeholders in the agricultural and/or forestry sectors in the Mediterranean basin.

This evaluation aims to understand the challenges they encounter while conducting their activities amidst current and future changes in land use, socioeconomic factors, and the environment. Both external and internal conditions impact the viability of these activities and their ability to adapt and recover from disturbances caused by natural hazards and other socioeconomic impacts. The survey is designed to explore strategies to reinforce agricultural and forestry activities in the Mediterranean within the framework of landscape resilience.

The survey is organized into different sections according to different **sub-objectives**, each serving a specific purpose in the process of identifying needs and potential solutions:

- In the first section, the focus is on identifying the main sectors of activity, corresponding professional profiles, age range, years of experience, and territory (see chapter 3.1).
- The second section aims to identify the primary impacts affecting the activity, considering the frequency and intensity of climatological and meteorological conditions. This includes changes in patterns, occurrences of extreme events, and understanding how these factors affect the activity. Additionally, the section aims to identify land-use and socioeconomic changes, directly or indirectly related to climate changes, which impact agricultural or forestry activities (see chapter 3.2).
- The third section aims to explore current global challenges in land management and ways to better prepare agriculture and forestry practices for the future, ensuring their continuity. This includes identifying the challenges and feasibility of current management practices, evaluating currently available supporting tools and their level of development, and assessing their significance in improving the viability of these activities. Furthermore, the third section seeks to understand the degree of impact of challenges on daily activities and their continuity. It also aims to identify the adaptation process of management practices to these environmental and socioeconomic changes. This involves exploring relevant tools, such as available information on practices, technology, supporting governance strategies, plans, policy measures, and accessibility to financial support and subsidies to cope with changes (see chapter 3.3).

2.2 Methodology

The analysis was conducted through a Mediterranean-wide survey **launched** on the EU Survey platform from October to December 2023. The survey **targeted** farming and forestry practitioners across the LandNet (including the LandLabs) and the Focal Points related to the ResAlliance project and beyond fall into the following categories:

- Farmers and forest owners, along with related professional organizations and associations.
- Technicians from extension services and forest administration (and related private sector).
- Other land managers (e.g., NGOs and managers of protected areas) and planners (e.g., public officers under agriculture and forestry policies).
- Training and applied research institutions on agriculture and forestry.

To match the diversity of territories represented in the project and the corresponding diversity of agricultural and forestry activities, the survey underwent several rounds of feedback among project partners. Initially designed in English, the survey was then translated into the **languages** spoken in each territory, including Arabic, Catalan, French, Greek, Italian, Portuguese, and Spanish.

To address questions regarding landscape resilience to practitioners without directly mentioning the term, a set of both quantitative and qualitative questions was developed. These questions were structured into three main sections (see Figure 1):

- The first section, aims to gather **basic information about the survey respondents**, presenting fields of information to help define the respondent's profile, sector of activity, and country. The section included the questions about:

  a) Sector of activity
  b) Profile and site: profile, age, gender, years of experience within the sector, country, region, city.

- The second section aims to **identify the greatest impacts related to climate change and land-use change scenarios** that could challenge the respondents' activities. The section included the questions about:

  a) Frequency and intensity of the changes in climate and weather:
  - Change in meteorological/climate patterns/environmental conditions: frequency and intensity (from 1 to 5) of unusual high temperatures periods out of the season, temperatures above/below average, changes in rainfall distribution, sea level rise, and salinity, among others.
  - Extreme events: frequency and intensity (from 1 to 5) of windstorms, drought, Floods, Wildfires, among others.

  b) Which of the above-mentioned changes negatively impact the activity (the most and how):
  - Change in meteorological/climate patterns/environmental conditions: level of impact (from 1 to 5) of unusual high temperatures periods out of the season, temperatures above/below average, changes in rainfall distribution, sea level rise, and salinity, among others.
  - Extreme events: level of impact (from 1 to 5) of windstorms, drought, floods, and wildfires, among others.
  - Other indirect impacts on the ecosystem affecting the activity such as exotic animal/plant species invasion, etc. Or affected by measures and policies related to climate change scenarios (e.g., cereal harvesting prohibition or access restrictions to forest massif due to high wildfire risk, irrigation limitations, cultural fire use limitations due to air quality restrictions, etc.).

  c) Existing or potential land-use changes and global socioeconomic factors affecting the agricultural/forestry activity:
  - Level of impact (from 1 to 5) of urban/industrial development and competition for land/water, renewable energy development and competition for the land, and increase of recreation activities disturbing livestock and pastures, among others.

- The third section aims to **assess the challenges and opportunities** of current and potential future management practices and other tools supporting the respondents' activities. The section included the questions about:

  a) Management practices feasibility and challenges:
  - Supporting tools: degree of development and impact of the activity (from 1 to 5) of support from agriculture/forestry extension services, agricultural cooperative/forestry association, access to training programs, measures to improve access to the international market, Knowledge transfer from universities and research institutions, and contingency plans for recovery after disasters and emergency relief payments, among others.
  - Identification of challenges: up to what extent (from 1 to 5) the specified challenges are part of the daily activity: lack of technical innovation due to limited investment capacity, lack of management innovation due to lack of access to new knowledge and practices, Managerial difficulties on adopting all legal requirements, and limited access to the land, among others.

  b) Adaptation of management practices to environmental/socioeconomic changes:
  - Identification of additional management practices necessary to improve the current situation regarding the impact of environmental/socioeconomic changes.
  - Identification of which information, knowledge and/or technology is used and missing to cope with the previous changes identified.

  c) Other tools and capacities to support the activity to cope with impacts of environmental/economic changes:
  - Identification of research necessary to provide solutions regarding the impacts identified.
  - Identification of the financial tools necessary to improve the situations regarding the impacts identified.
  - Identification of additional good practices, references, etc., which can help to make agriculture and forestry activities in the Mediterranean region more resilient.

- A final short part was enabled to add other comments or final remarks, and to mark if the respondents were interested in receiving the results of the survey when edited.

40 minutes was the estimated time needed to fill out the survey.

SECTION I. PROFILE, FIELD OF ACTIVITY AND SITE	SECTION II. RELATED CLIMATE CHANGE AND LAND USE CHANGE SCENARIOS IMPACTS ON THE ACTIVITY	SECTION III. MANAGEMENT PRACTICES IN AGRICULTURE AND FORESTRY, PRESENT AND FUTURE
I.1 Sector of activity I.2 Profile and site	II.1 Frequency and intensity of the changes in climate and weather II.2 Which of the above-mentioned changes in climate or meteorological conditions negatively impact the activity the most (and how) II.3 Existing or potential land-use changes and global socioeconomic factors affecting the agricultural/forestry activity	III.1 Management practices feasibility and challenges III.2 How to be better prepared to environmental/economic changes? III.3. Other tools and capacities to support your activity and to cope with impacts of environmental/economic changes

Figure 1. Survey general structure

To see all the details and the complete survey, see Annex I.

All participants provided consent for the survey procedure and confirmed being over 18 years old. Participation in the survey was voluntary, and responses were anonymized, exclusively analysed in the context of the ResAlliance project. The survey outputs are stored in a database and serve as the basis for this report.

The survey **dissemination** took place in two ways:

- Firstly, the survey provided additional guidance in the initial LandLab *exploration workshops*, aiming to identify and assess farmers, foresters, and related stakeholders' views from the territories. A common methodology for the survey application across the exploratory workshops was provided to the ResAllience Ambassadors (which act as a coordinator of the LandNets) by the survey developers during the training provided by the Task 2.1 (Setting up and managing a Community of Practice), ensuring a homogeneous understanding of the survey, its proper use, and dissemination.
- Secondly, it was shared online with farming and forestry practitioners across the LandNet, including the LandLabs, the Focal Points and beyond through direct invitations via email to other stakeholders and partners, such as the Mediterranean Biosphere Reserves Network, among other partner networks.

For the results **analysis,** the answers were exported in an Excel spreadsheet, which was treated to produce most of the results showed in this report, especially the graphics and the qualitative answers. In general, a basic treatment of response grouping has been conducted. This means that no variables have been crossed. Responses have been aggregated by type and response group, when possible (in the case of quantitative responses), and always shown as a percentage value, excluding non-answers from the total. Thus, 100% is always shown based on the number of responses obtained for each question. Not all the questions have the same rate of answer, which is why each graphic displays the number of answers, separating, when necessary, the sample by each variable (e.g., intensity and frequency) if they are different even if they are referred to a unique field. It is important to note that the economic sector and profile questions (Figure 3 to 6) consisted of multiple- choice questions, where the respondents could mark more than one of the proposed options. The number of answers (n) displayed in the graphics thus refers to the number of respondents rather than the total number of answers. For qualitative responses, no specific treatment has been applied, and the obtained responses have simply been shown. To avoid statistical mistakes, the results achieved by the Excel file were compared and supported by the automatic statistics produced by the EU Survey platform, especially in the case of quantitative answers. Considering the length and complexity of the survey, the graphics of the results show the rounded values (without decimals) and the responses organized (when possible) from more frequency/intensity/impact to less in order to facilitate the interpretation and reading of the figures. According to the very diverse sample per country, profile and sector of activity (see chapter 3.1), no segmentation of results was done in order to show the results as homogeneous as possible.

All statements in this document originate from the survey, and there are no statements from the editorial team. In cases where the content is not part of the survey results, a citation has been included. Note that only the final remarks chapter includes statements from the editorial team.

2.3 Profile, field of activity and site

This chapter includes the overall responses, the profile, field of activity and territory of the respondents. This section also identifies the sector of activity.

A total of 82 responses have been collected from 11 Mediterranean countries. Represented **countries** are Tunisia (30%), Italy (21%), Greece (16%), Lebanon and Spain (8% each one), Cyprus (6%), Portugal (4%), Albania, France, Morocco and Slovenia (1% each one). There is also one answer without country attached. All the targeted territories, represented in the ResAlliance project, were reached; however, the representation is uneven.

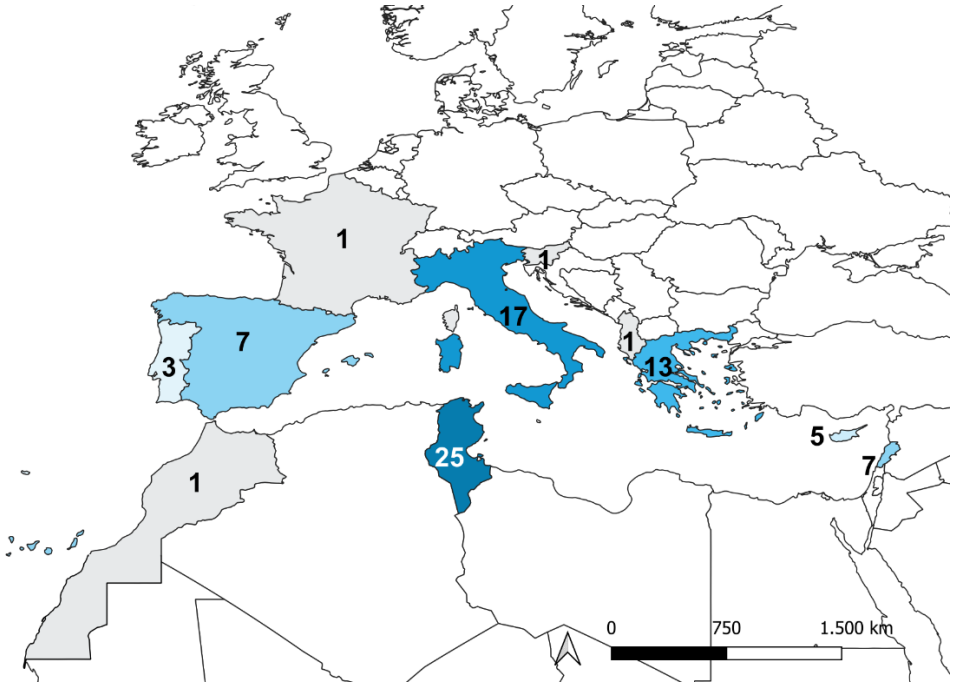

Figure 2. Number of responses per country

Economic sectors represented in the survey are, from less to more, forestry (23%), agriculture (21%), management of protection forests, fire prevention, and forest health (15%), management of protected areas (9%), other agro-forestry related activities, and eco-tourism (8% each one), apiculture (3%) and livestock (1%). Other sectors (13%) represented are local administration, agricultural and climate research, biodiversity conservation, environmental management and protection, and maintenance of river basins (Figure 3).

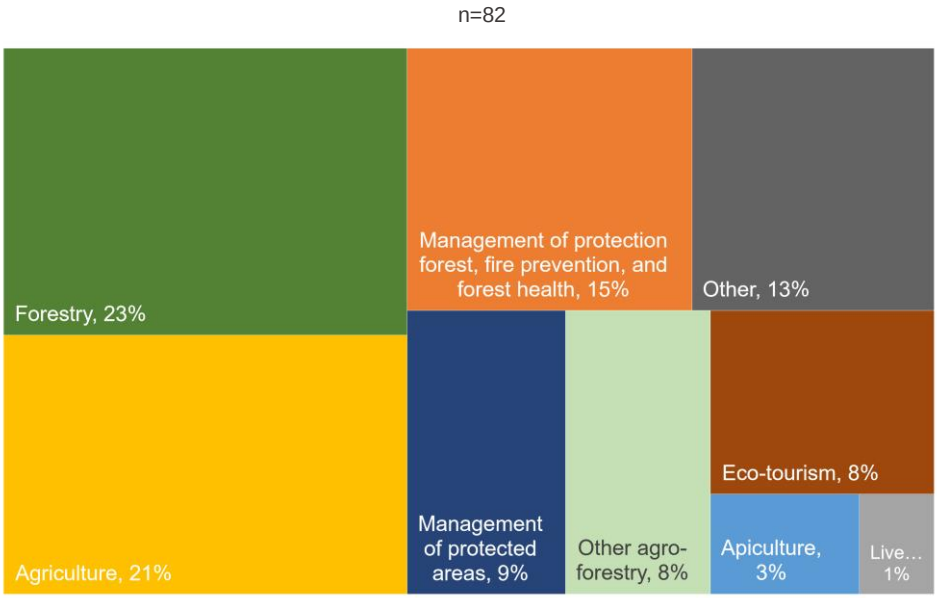

Figure 3. Respondents economic sector

Within the forestry sector, it is specified that the wood forest is the most representative activity (17%), jointly with others such as biodiversity conservation, geographical information systems analysis or forest planning (Figure 4). For the agricultural sector, the most representative activity is the vegetable production (17%) followed by the olive orchards (13%) and the olive cultivation (12%). Very close to those, there is the irrigated crops (10%) and the cereal and other rainfed crops (9%) (Figure 5).

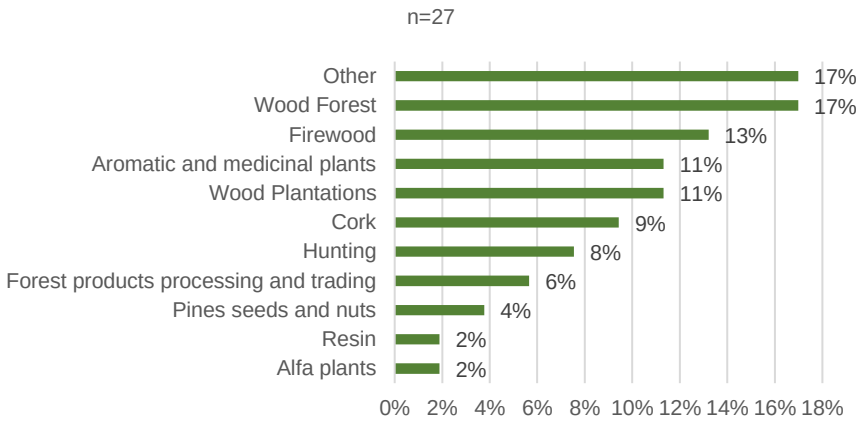

Figure 4. Sepcific activity within the forestry sector

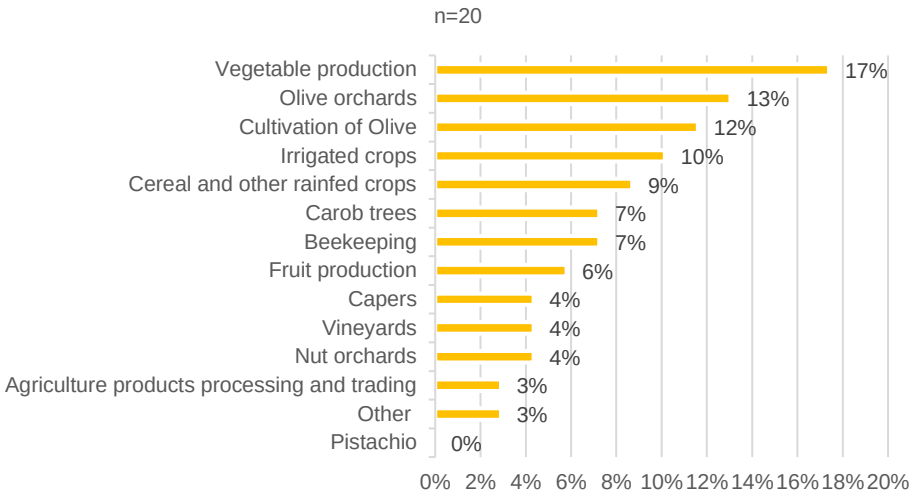

Figure 5. Specific activity within the agricultural sector

Regarding the **respondent profiles** (Figure 6), the main ones are those attached to a research institute on agriculture or forest (14%), followed by foresters and farmers (12% each one). Then, trainers/professors at a professional school (10%) and managers of protected areas (10%) are the fourth and fifth group more represented. The option 'other' (16%) includes NGOs, environmental technician, civil protection volunteer or consultant, among others. It is important to remark that in the case of the sector of activity and the profile a surveyed could mark more than one option (e.g., 'farmer', 'policymaker' and 'other').

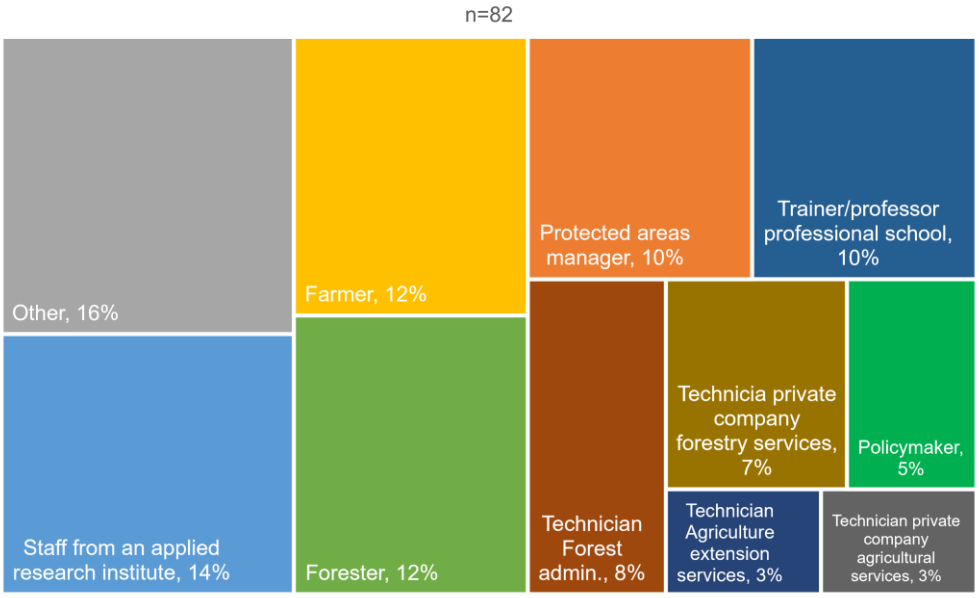

Figure 6. Respondents profile

The majority of respondents (42%) are in the **age range** of 31 to 45, then in the range of 46 o 60 (34%), the 18 to 30 (14%), and lastly over 60 years (10%). About the **gender**, roughly two thirds of the respondents (72%) are male and one third are female (27%), while the rest marked “prefer not to say”. Half of the respondents (50%) have 15 or more **years of experience** in their sector (Figure 7).

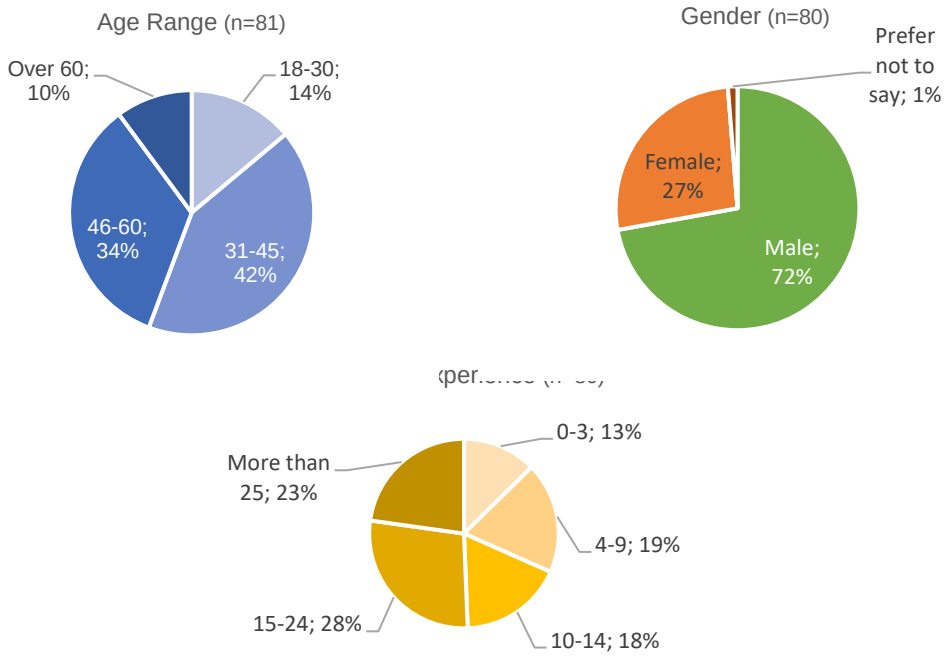

Figure 7. Respondents’ age range, gender and years of experience within the sector

3 Needs, barriers, bottlenecks, innovation and knowledge gaps to achieve Mediterranean resilient landscapes for agriculture and forestry

This chapter aims to identify and understand the survey’s results, and to put the basis for the corresponding discussion and conclusions.

The content includes two sub-chapters organized according to the survey structure, as follows:

- The climate change and land use change impacts identified according to the respondent’s perception and experience, including the changes in climate and weather, and the existing or potential land use changes and global socio-economic factors. This section aims to identify and describe the objective of the resilience (resilience to what).
- The management practices, including their feasibility and challenges, the adaptation to environmental and socio-economic changes, and the identification of other tools and capacities to support the activity and to cope with impacts of environmental/socio-economic changes. This section aims to identify and describe the useful and missing practices from a surveyed point of view.

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3.2 Identified impacts of climate change and land use change

Frequency and intensity of the changes in climate and weather

The survey respondents were asked to reflect on a set of **environmental disturbances and conditions** currently happening, **comparing to the past** 15-20 years or the period of their experience in the field. Respondents identified notable changes in climate and weather conditions, including temperature variations, rainfall patterns, sea level rise, and extreme events.

Globally, an increased occurrence of high temperatures during autumn to spring, indicative of a milder winter period, was observed, along with a reduced frequency of low temperatures from spring to autumn, indicating a warmer summer period. Results underscored a notable trend towards above-average temperatures both in frequency and intensity, conversely to a much less frequent occurrence of below-average temperatures (Figure 8 and 9).

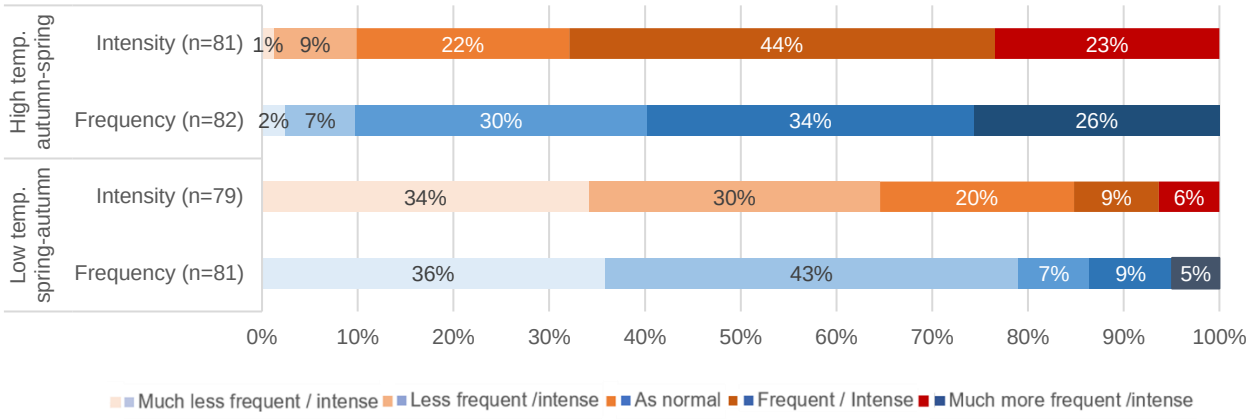

Figure 8. Intensity and frequency of unusual high & low temperatures compared to the past

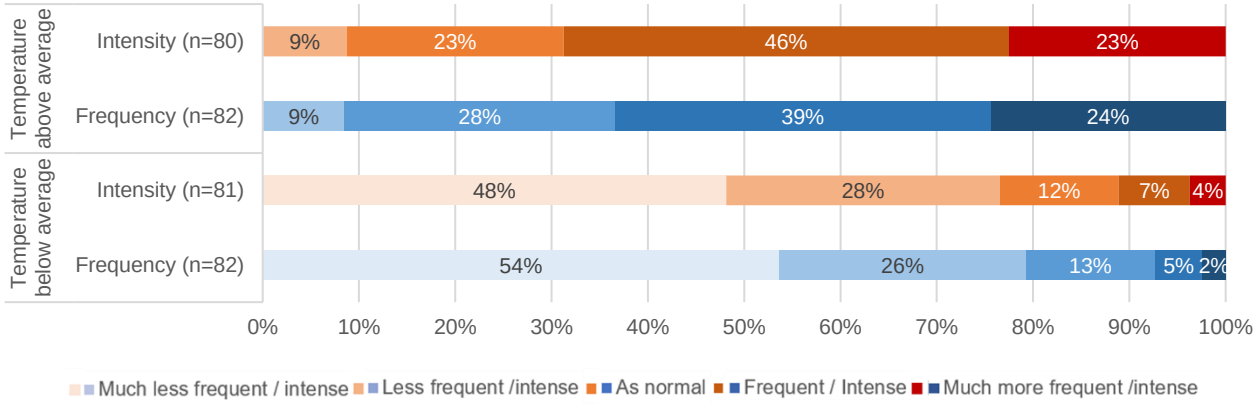

Figure 9. Intensity and frequency of temperatures above/below average compared to the past

In terms of rainfall, there was an overall escalation in the frequency and intensity of changes in distribution, while above-average rainfall was globally less frequent and less intense, though a quarter of responses indicated rainfall variations being "as normal" (Figure 10). Regarding the windy variations, highlights the less and much less frequent windy days below average (Figure 11). On the other hand, other factors were assessed, such as the sea level rise, which showed mixed perceptions, with a high number of responses reporting "much less" frequent (37%) and intense (40%) occurrences, and another high percentage (almost one-third) considering it "as normal" (29% in frequency and intensity). Also, the salinity showed a mixed perception, but in this case more equal than the previous one, since the intensity and frequency of "much less" are both represented by 32%, while the responses perceiving the situation "as normal" are represented by 31% in frequency and 34% in intensity. In both sea level rise and salinity no direct relation between the responses and the country was found. Finally, the soil degradation is mostly represented by "as normal" (46% for the frequency and 37% for the intensity) (Figure 12).

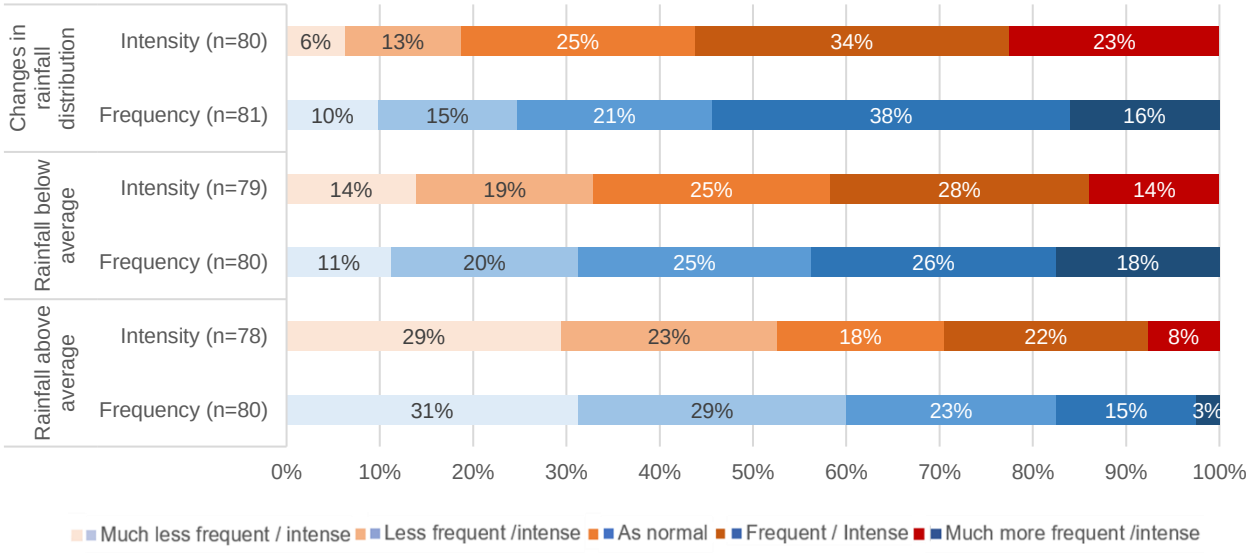

Figure 10. Intensity and frequency of the rainfall variations compared to the past

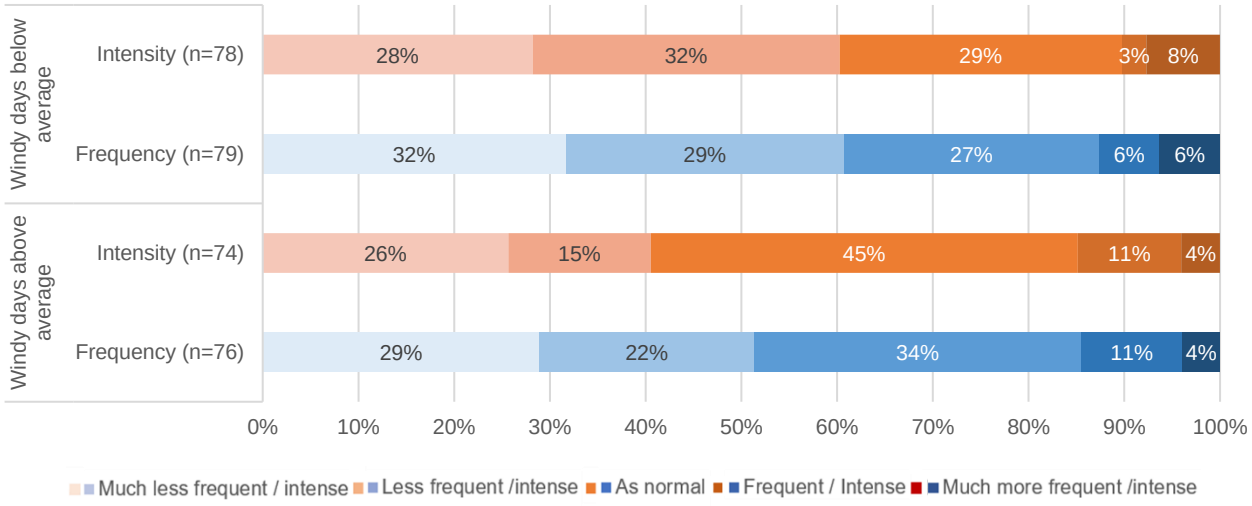

Figure 11. Intensity and frequency of the wind variations compared to the past

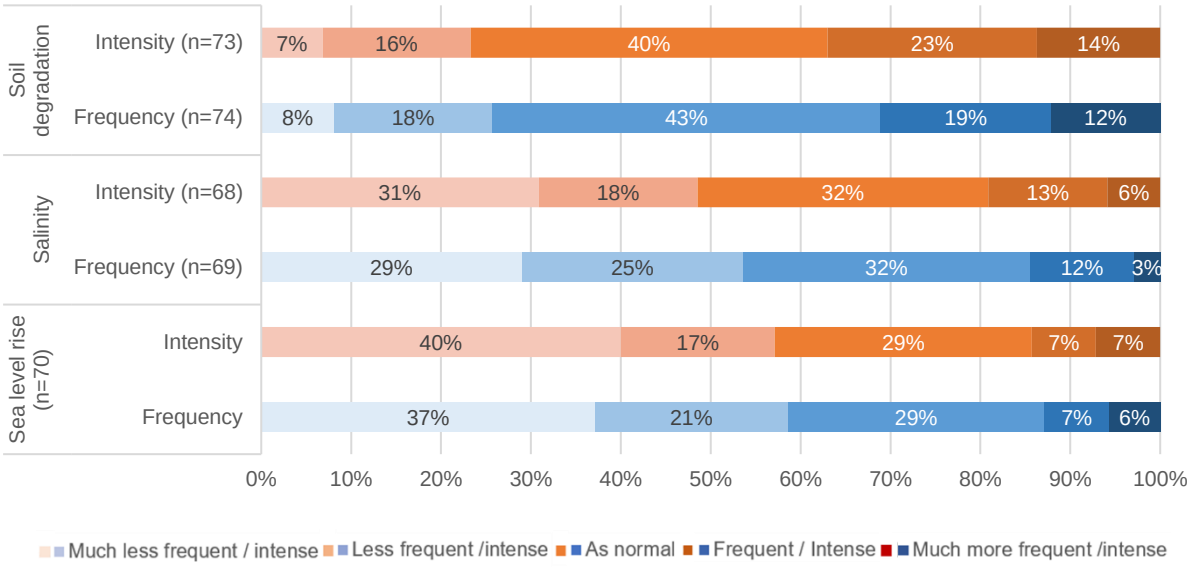

Figure 12. Intensity and frequency of the soil degradation, salinity and sea level rise compared to the past

In regard to **extreme events**, the survey noted a substantial decrease in the **frequency and intensity** of cold waves and a moderate decrease in hailstorms and windstorms. Conversely, there was a marked increase in the frequency and intensity of heat waves and droughts, alongside a moderate rise in wildfires and pests & diseases. Interestingly, a notable proportion of responses categorized these extreme events, along with floods, as 'normal' in terms of both frequency and intensity (Figure 13). Other extreme events were also identified, such as the land subsidence and landslides, and the heavy wet snow at low altitudes and large snow accumulation which rapidly melts.

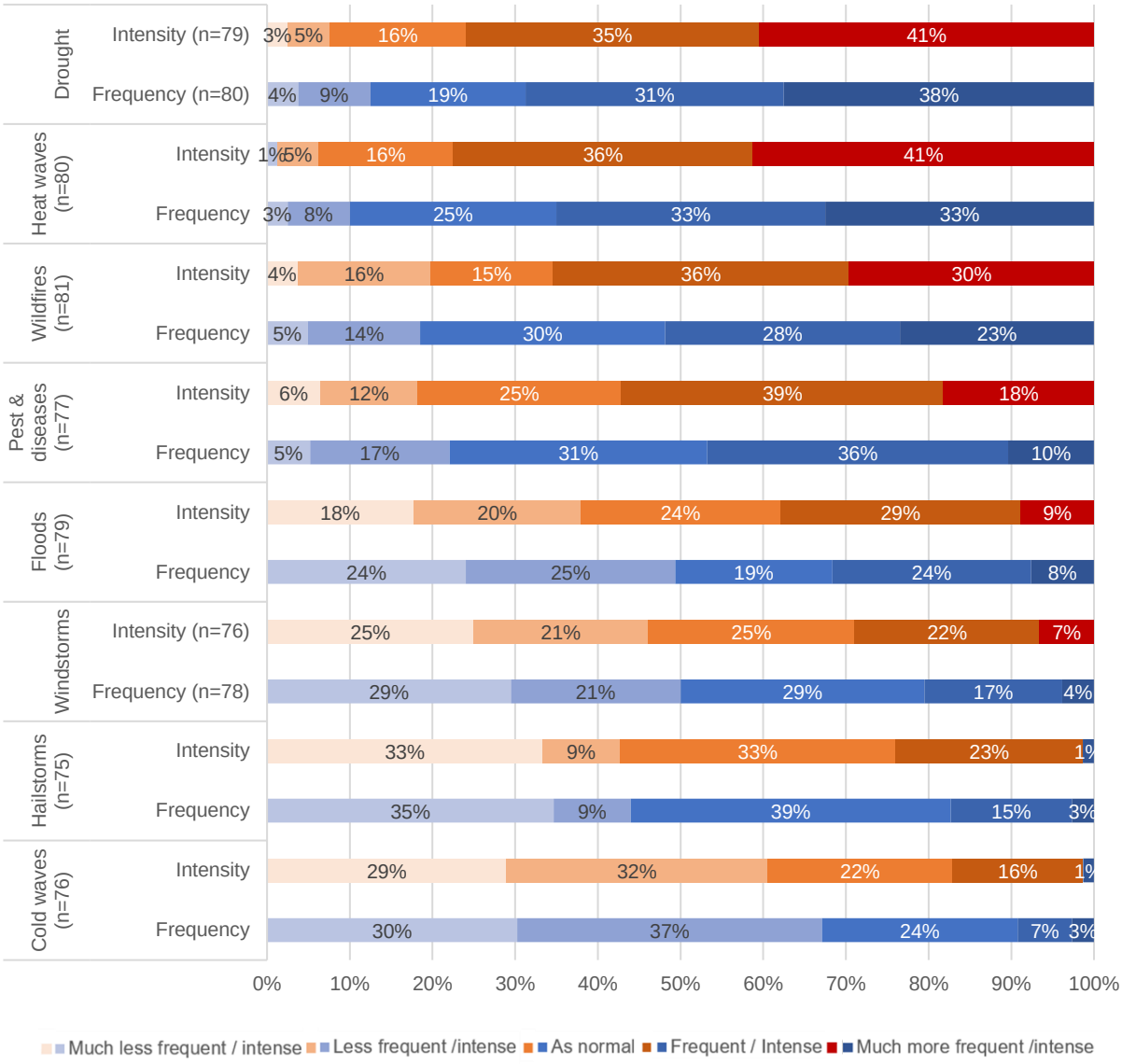

Figure 13. Intensity and frequency of extreme events compared to the past

Negative impacts on the activity

The respondents were asked to indicate the extent to which they considered the **disturbances and conditions** to **affect their activity**. Results show that the climatic changes carried varied negative impacts on the surveyed activities, with close to 60% of responses indicating strong or very strong changes in climate patterns such as below-average rainfall, altered rainfall distribution, above-average temperatures, and elevated autumn and winter temperatures (Figure 14). The other negative impacts identified are the decrease of snowfall in mountains, which is reducing stream run-off and water reserve in spring, long periods of drought with high temperatures and intense winds, the duration of drought, the frequency of hot dry winds in winter and autumn and tropical nights, among others.

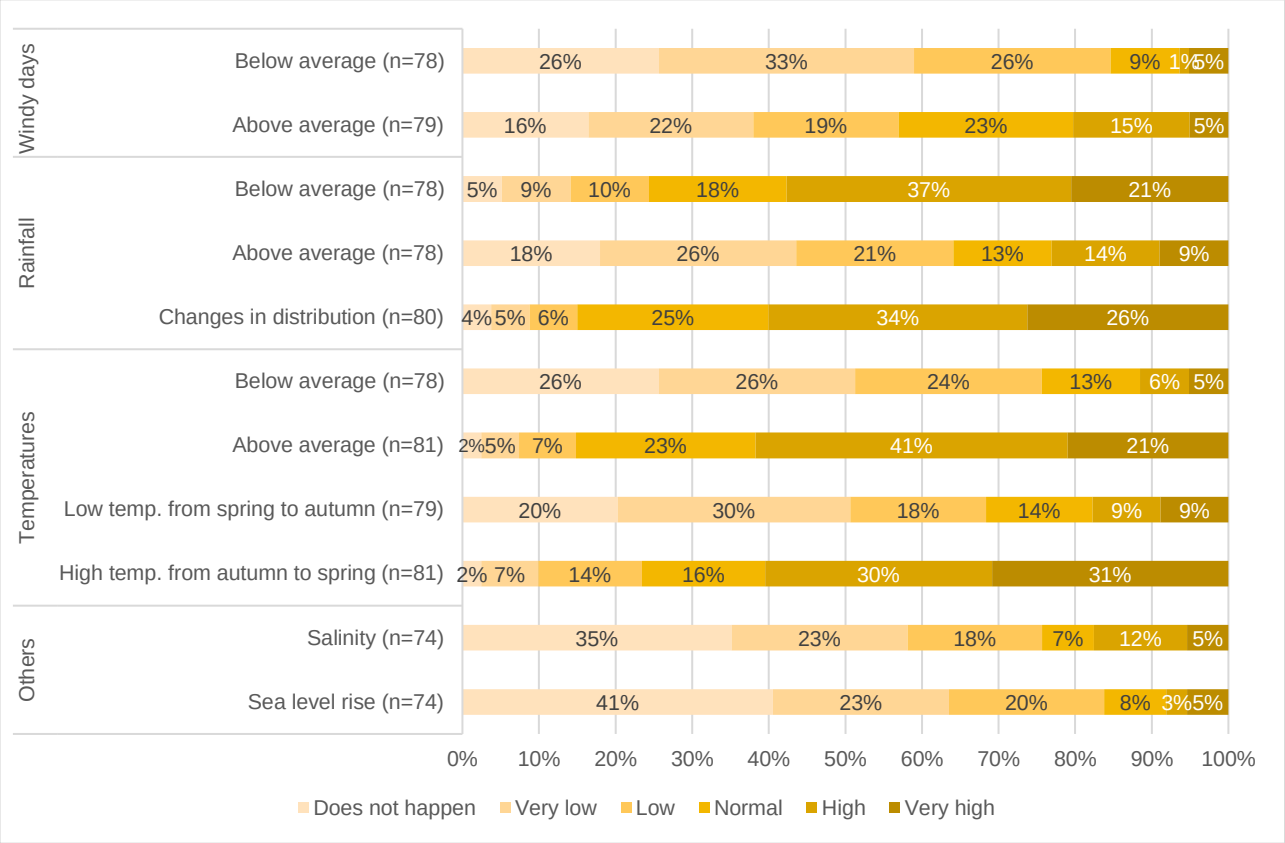

Figure 14. Level of impact of changes in meteorological and environmental conditions and climate patterns on respondents activity

Extreme events impacting the most to the respondent´s activities in the surveyed countries are drought (32% high and 47% very high impact), heat waves (39% high and 33% very high impact) and wildfires (35% both high and very high impact). The level of impact of cold waves, mainly indicated as non-existent (23%), very low (33%) or low (16%) impact, shows an inverse trend relative to heat waves (Figure 15). Confirming again the above-mentioned trend of increased occurrence of high temperatures versus low temperatures, especially out of season. Another impact identified by a respondent was the rapid and intense accumulation of wet snow in low altitudes, which melts very fast and has direct affectation to the trees.

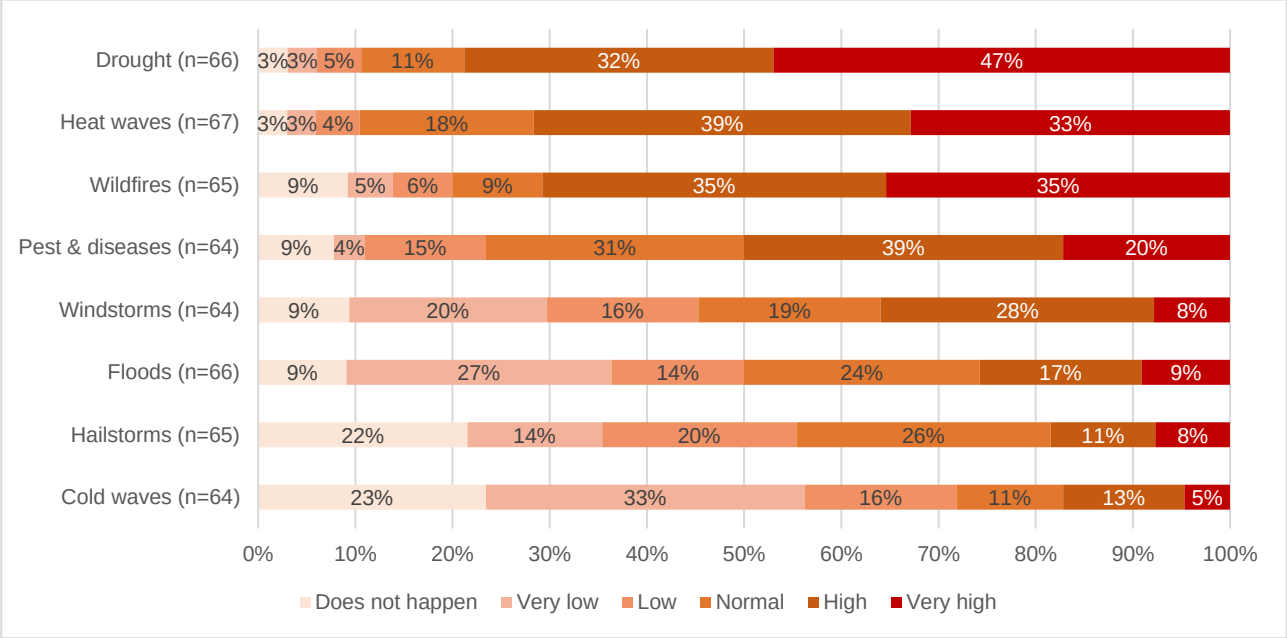

Figure 15. Level of impact of extreme events on respondents activity

Beyond the direct effects already analysed, **indirect impacts** on the **ecosystem** included the proliferation of alien and invasive species, heightened vulnerability to pests, diseases, and parasites were also assessed. Specifically, this was designed as an open question. That is, additional information on the impacts on the ecosystem affecting their activity was provided by the surveyed. They covered a range of environmental issues, offering a broader view of the challenges faced in different aspects of the ecosystem. The responses can be grouped in three main topics: vegetation, wildlife, and human-induced related issues. On one hand, the indirect vegetation-related issues are linked to the advancement and/or postponement of flowering, ripening, and fruiting in plants, the regression of endemic plants due to invasive species (such as *Solanum, Robinia, Ailanthus, Senecio inaeqidens*), the resistance of parasites to chemical substances, the increase in pests (such as bark beetle or tree parasites in chestnuts), the increase of wildfire risk or the loss of biodiversity. On the other hand, the indirect wildlife-related issues are linked to the change in animal behaviour, especially birds changing their wintering habits, the appearance of the invasive species (such as the blue crab in the aquatic environments) and animals' overpopulation (plague), among others. Finally, the indirect human-induced environmental issues are linked to the modification of combined production systems, the dominance of one system over another leading the degradation of soils, forests, or biotope resources, the increase of wildfire risk due to biomass accumulation and the abandonment of agroforestry and forestry systems, the deterioration of vegetation cover and increased sedimentation in dams, and the modification of landscapes.

The survey respondents provided **additional insights** on the **measures and policies** related to climate change scenarios (indirectly) affecting their activity. The answers cover a range of environmental and agricultural policies, restrictions, and challenges. This was also an open question, and the responses are related to different thematic. On one hand, some effects related to fire prevention and forest management were identified such as the access restrictions to forests due to wildfire risk or other reasons, the limitations in the use of fire or the activities restricted after a fire. On the other hand, there are other effects related to water management and irrigation, such as the water restrictions, or the lack of irrigation due to limitations on water use. Finally, some other mentions were referred to the collapse of agroforestry management maintaining multifunctional landscapes, the threats from imposed land-use changes, particularly the installation of numerous wind turbines causing irreversible changes to mountain ecosystems, or the cereal harvesting prohibition and restrictions on emergency irrigations, among other.

Socioeconomic factors affecting activity

Besides changing meteorological and environmental conditions as well as changing climate patterns, **socioeconomic factors** may also **affect the viability of the activity**. According to the survey, these pre-defined factors are primarily attributed to factors such as a lack of political stability, insufficient long-term policies, urban and industrial development, water competition, increased poverty, rural depopulation, unsuitable infrastructures, and a shortage of skilled workforce, each marked as having a high or very high impact by over 50% of respondents.

As shown in Figure 16 the lack of political stability and long-term policies is, by far, the **main impact identified** by surveyed (42% very high and 12% high impact), followed by unsustainable infrastructures (33% very high and 25% high impact) and urban/industrial development and competition for water (38% very high and 16% high impact).

According to the qualitative answers from the survey, regarding political stability and policies, it is pointed out that they are addressing problems lacking long-term sight, the excess of bureaucracy, the lack of policy coherence[1] between administrations and sectors, the difficulty to adapt the activity to the short-term changes in policies, among others. Related to the unsustainable infrastructures it was highlighted the lack of roads, which difficult the establishment of new population, the response to natural hazards such as wildfires and the profitability of human activities.

In parallel, the increased pressure on water resources results in a general water shortage, affecting various sectors. An example, provided by a respondent, of conflicts arising from water usage involves the tension between the tourism and agricultural sectors during the summer period, both needing the same water resources. Additionally, the urban and industrial sector competes for water, often capitalizing on its necessity and economic development advantages, resulting in its prioritization. Human-made infrastructure, such as boreholes with pumping, contributes to groundwater depletion, while structures like dams intensify water stress on forests, leading to forest degradation. Rapid urban expansion is altering domestic water use, relying on dams, aquifers, and desalination. Another detrimental exploitation of water resources is evident in the licensing of numerous hydroelectric projects in sensitive mountain streams, leading to the permanent damage and destruction to fish fauna.

On the other hand, it was also highlighted that the development and installation of renewable energy infrastructures, such as wind turbines and photovoltaic panels, and the expanding urban sprawl, particularly along residential areas, can result in irreversible damage to soils and potential disruption of natural environments, including forests. The competition for prime agricultural lands due to urban and industrial expansion leads to their disappearance. More land is allocated for housing and industries, especially in close proximity to cities. Forested areas often experience shrinkage and degradation due to urban expansion. Moreover, urban and industrial activities contribute to air and water pollution, and the increased vulnerability leads to an increased risk of invasive pathogens and insects in forests. In some instances, this contributes to heightened natural disaster risks, such as flooding in urban areas nearing wetlands. Lastly, perceptions of natural spaces differ among urban and more typically rural environments, with urban areas often regarding forests as land reserves without acknowledging their environmental and ecosystem values.

The **less marked** pre-defined factors are the illegal harvesting in the properties, the increase of recreation activities disturbing livestock and pastures, and the renewable energy development and competition for the land (all of them with approximately 20% high and very high impact).

[1] Understanding it as systematic promotion of mutually reinforcing policy actions across government departments (OECD 2023, Driving Policy Coherence for Sustainable Development: Accelerating Progress on the SDGs, OECD Publishing, Paris)

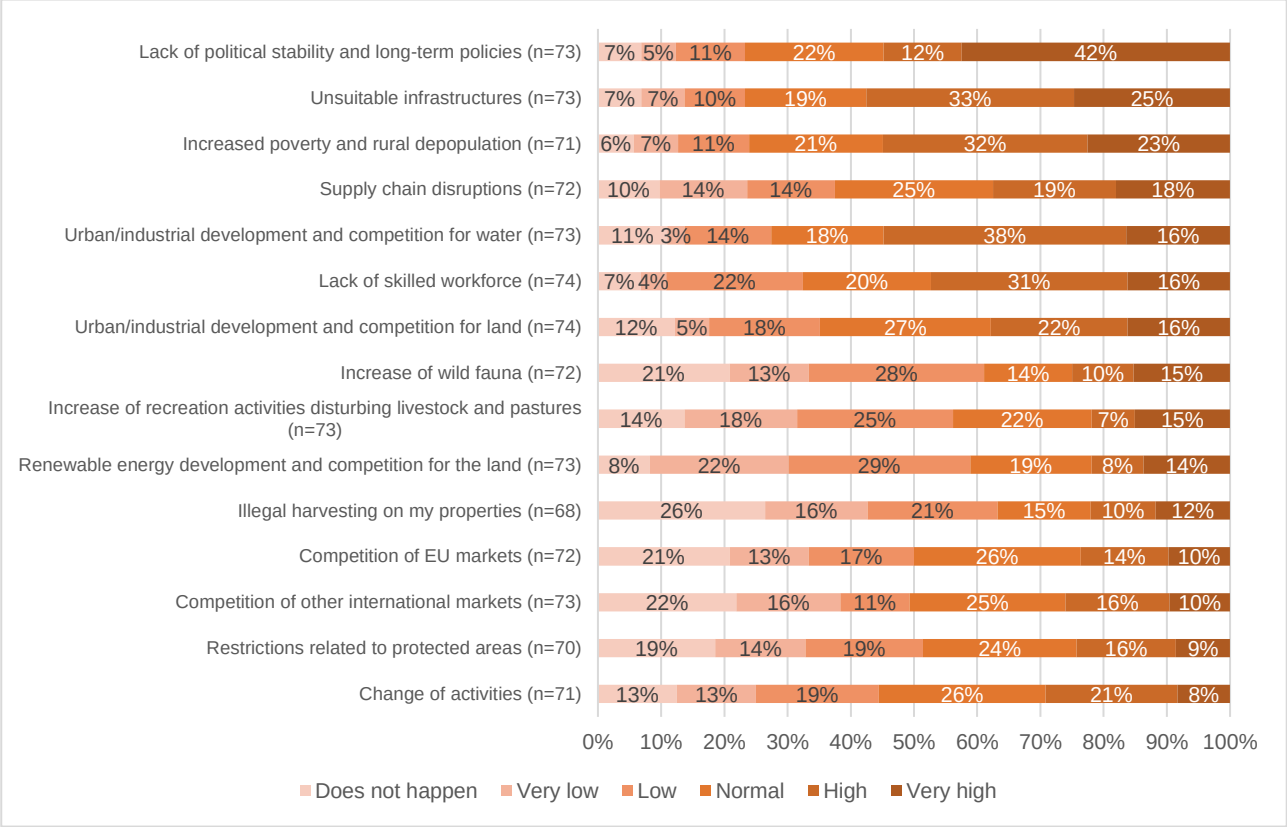

Figure 16. Existing or potential global socioeconomic factors affecting respondents activity

Some **additional factors with impact** to the activities were identified, such as below average incomes in the agricultural and forestry sector, the equipment being very expensive, the restrictions surpassing support in the field of forest tourism activity, existing inconsistencies in public agricultural policies, the non-adherence to procedures to preserve the extent of agricultural lands and the urban development simultaneously expanding at the expense of agricultural lands and the lack of promotion of local production by the industry.

3.3 Management practices

Management practices feasibility and challenges

The majority of the **practices** presented in the survey were characterized as either missing or not well developed. Particularly noteworthy, with over 60% of responses highlighting them as such, are the absence of facilitation for loans and investments, inadequate support for the activity, limited access to national and international markets, insufficient access to exchange programs, and the absence of affiliation to trade unions, insurance systems, and cooperatives or associations.

Specifically, the joint/grouped land management, the contingency plans for recovery after disasters and emergency relief payments, the financial facilitation of loans and investments, the financial support to the activity, and the existence of local products processing industries are **considered** the **less developed** (Figure 17). Additional underdeveloped practices contributing to challenges include the absence of contingency plans for recovery after disasters, the lack of local product processing industries, insufficient joint land management,

limiting size of the property, inadequate transport infrastructures, and the insufficient maintenance of price stability.

Relatively to the other management practices, traditional knowledge was highlighted with the **highest degree of development**, followed by the knowledge transfer from university and research institutions, the access to training programs, the transport infrastructures, and the support from extension services. It is important to highlight that the good value is related to their advanced development, decreasing the punctuation linked to that they are in place and well developed (Figure 17).

Figure 17. Development degree of support tools

In assessing the level of impact on the activities, the support tools **considered** with a **highest impact** are the transport infrastructures, the institutions of research and innovation, the knowledge transfer from universities and research institution, the financial support to the activity, and the maintenance of price stability. Then, access to exchange programs, promotion of local market and consumption of local products, financial facilitation of loans and investments and the traditional knowledge are also appreciated. In parallel, the support tools with **less impact** on the activity are the affiliation to trade unions, the insurance systems, the association, the support from extension services, and the grouped land management. Followed by the professional schools, the access to training programs and the measures to improve access to the international market (Figure 18).

Consequently, knowledge transfer from universities and research institutions and transport infrastructures are the unique two support tools well positioned in terms of both development degree and impact on the activity. At the same time, there are no tools that concur in their lack of impact on activity and the degree of development.

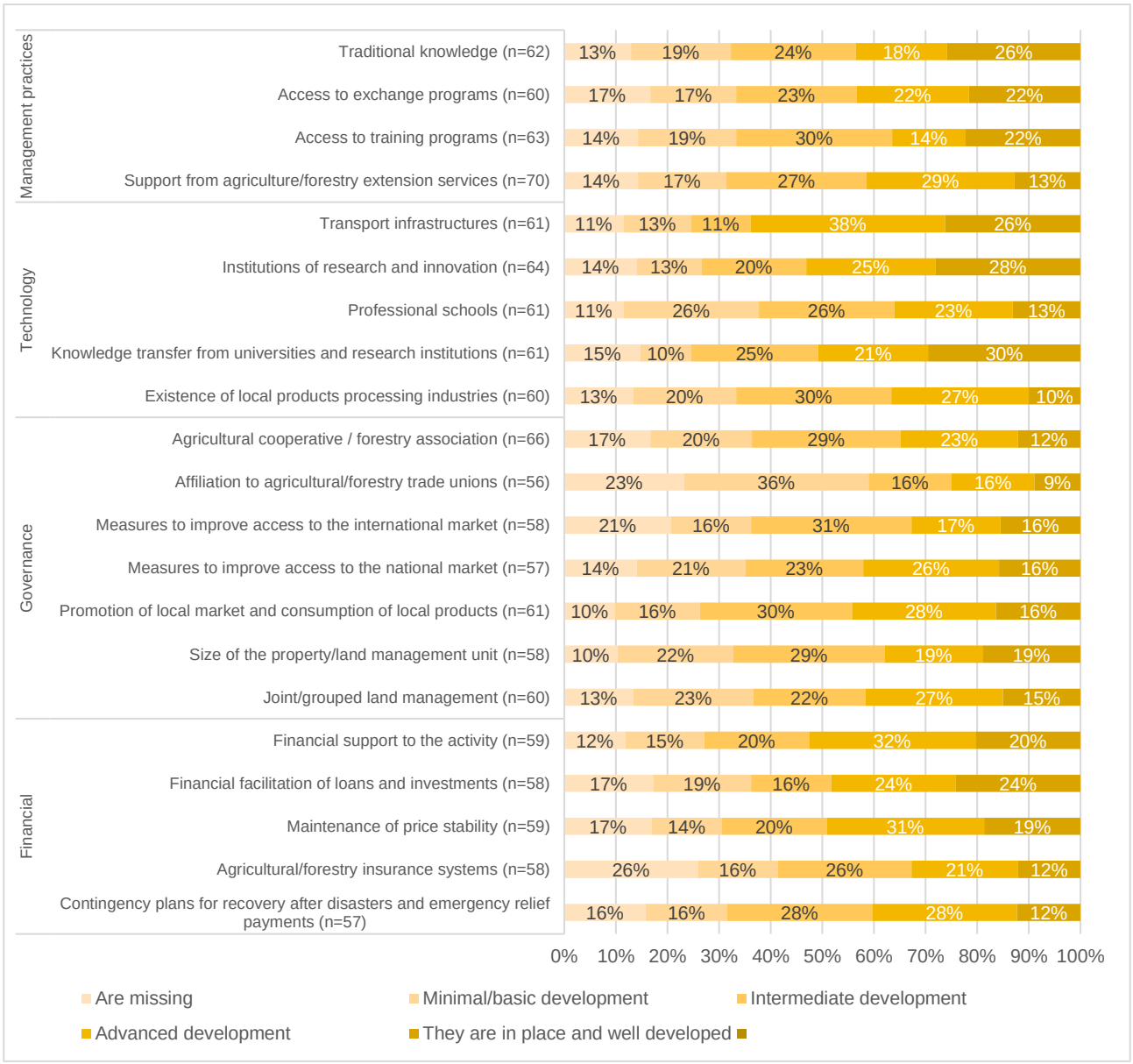

Figure 18. Impact level of support tools on the activities

Challenges to **daily activities**, marked as **highly limiting**, with over 60% of responses indicating them as limiting or strongly limiting, include: excessive bureaucracy and administrative formalities, difficulty in adhering to all legal requirements at both financial and managerial levels, challenges in adopting necessary measures to address extreme events and associated economic losses, difficulty in adapting activities to new conditions, constrained by administrative procedures and management practices calendar, low economic profitability of the activity, lack of skilled workers, absence of family farming business continuity with younger generations, limited alternatives in terms of suitable activities to fit the new environmental conditions.

Figure 19 shows the main five challenges limiting the activities. In parallel, the aspects **not affecting or with less limitation** to the activities are the unproper definition of property rights, the limited access to the land, the lack of management innovation due to lack of access to new knowledge and practices, the inadequacy of traditional management practices to new conditions or the lack of technical innovation due to limited investment capacity (Figure 19). **Additional challenges** identified to daily activities arise from the segregation of agriculture and forestry under different administration bodies, complicating coordination and integrated planning efforts. This division is further exacerbated by the land classification system and inadequate subsidy policies. Furthermore, the acquisition strategy of large state-owned companies is driving up forest plot prices and disrupting the market equilibrium. Concurrently, many laws are limiting the state´s disposal of land, with the potential to exacerbate this issue further.

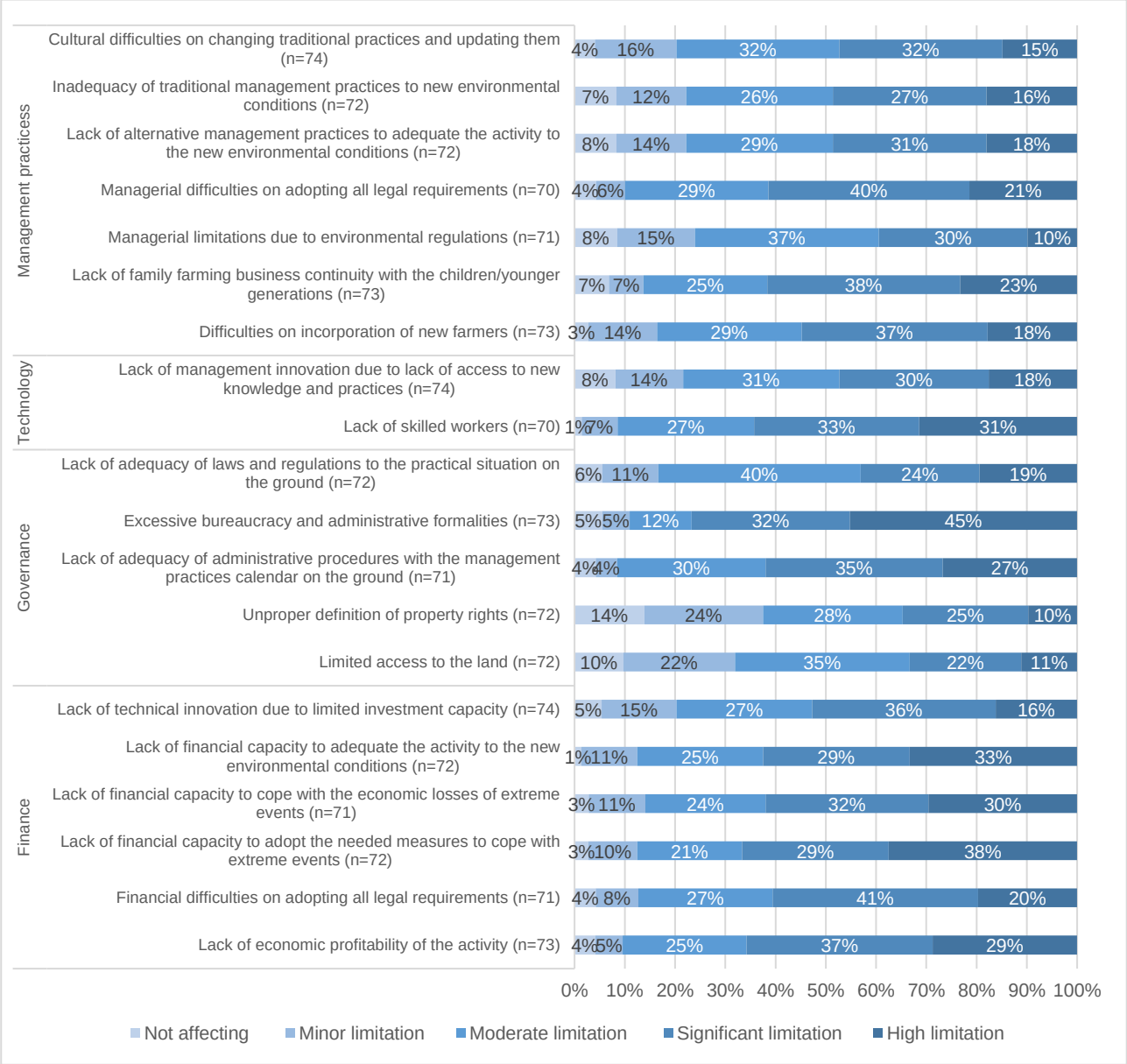

Figure 19. Challenges affecting the daily activities and their continuity

Adaptation of management practices to environmental/socioeconomic changes

49% of the respondents have indicated that they felt compelled to **change practices due to socio-environmental changes** (Figure 20), with 30% of them acknowledging the availability of territorial management practices that could be used (Figure 21). Among these respondents, some examples were given of practices believed to facilitate progress, such as agroforestry, the development of natural meadows and rangelands, silvo-pastoral practices, and regenerative agricultural practices. **Limitations experienced** for the implementation of said practices (*Table 1. Experienced limitations regarding practices which could facilitate the adaptation to environmental/ socioeconomic changes*Table 1) include excess of bureaucracy, social constraints such as closed mentalities to change or misconceptions around specific management practices (for example perceiving any kind of forest interventions as detrimental), pressures from large agricultural businesses,

inconsistencies in European aid to certain objectives (such as the preservation of hedges, natural meadows, etc.), the lack of incentives, of support from public administration bodies and of investment tools to move forward from conventional systems. As a follow-up, Table 2 offers an overview of either new management practices or advancements in existing ones, identified by the survey respondents as necessary to improve the situation regarding the impacts of environmental/economic changes on the activities.

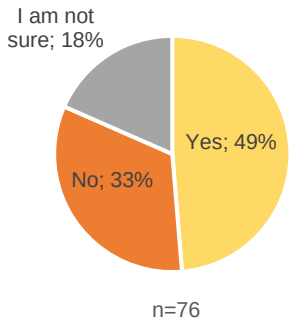

Figure 20. Change of practices due to socio-environmental changes

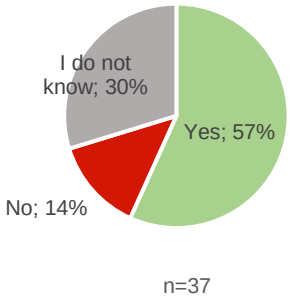

Figure 21. Use of available territorial management practices

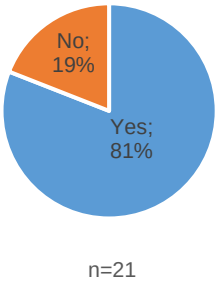

Figure 22. Adoptation of new or existing practices

Experienced limitations regarding practices which could facilitate the adaptation to environmental/socioeconomic changes
European agricultural aid that is not consistent with the preservation of hedges, natural meadows, etc.
Excess of bureaucracy
Institutional framework, investment tools
Lack of incentives for moving from conventional farming
Lack of involvement / ambition of the public administration (from technicians to policy makers)
Misconceptions on the impact of forest management (i.e. perception of the forest as a pristine landscape where any intervention is detrimental)
Pressure/lobbies from agri business companies
Social constraints (change of mentality needed)
Specific adaptation to the production of aromatic and medicinal plants

Table 1. Experienced limitations regarding practices which could facilitate the adaptation to environmental/ socioeconomic changes

Management practices needed
Support for the work of livestock farms by supporting the circular economy and the certification and promotion of free-range livestock products as opposed to closed - stabled livestock farming
Establishment of a botanical garden
Market policy: regulation of the “aggressive” nature of the market
Association and property union
No-till vs. weed control
Sobriety
Valuation of extensive livestock farming
Installation of hedgerows
Systematic disease management in chestnut with biological control and mixing of species for disease resistance
Agroforestry and agroecology
Pasture management plans - clearing of pastures
Promotion of multifunctional forest management
Flexibility of procedures
Tank
How to adapt the forest to environmental changes
Encouraging the use of renewable energies
Lack of technical services providers / where to rent the equipment instead of purchasing
Monitoring distribution routes
Agricultural guidance
Good appreciation
Limiting the value of bank interest
Well drilling license
Guidance
Facilitating the exploitation of agricultural lands under the authority of the state
Providing support
Accompaniment
Accompaniment and encouragement
Compatibility of laws and legislation with reality
Qualitative on adaptation to climate change
Monitoring
Providing pioneering examples in this field
Employing technology
Allocate part of the budget
Preparing a participatory strategic plan

Table 2. New management practices or advancements in existing ones necessary to improve the situation regarding the impacts of environmental/economic changes on the activities

Only 25% of the respondents agrees or fully agrees on the **availability of practical information** to adapt agricultural and forestry management practices to environmental and socioeconomic changes (Figure 23). Of these, just over half of the respondents believe they can effectively utilize it. Similarly, 30% of the respondents agrees of fully agrees on the availability of technology for the same purpose (think of digital maps, GPS

systems, mobile apps, drones, Smart Agriculture, and more), of which again just over half of the respondents consider it can be effectively utilized. As a follow-up, 43% of the respondents indicate there are **limiting factors** associated with the **use of technologies**, such as the lack of access and complexity of the tools, which can hinder their effective utilization (Figure 24). Frequently used technology to cope with the environmental and economic changes include cartographic data or satellite images, weather and climate data, smart farming, and agricultural production simulators (e.g. APSIM). Further needs in terms of knowledge and technology identified by the survey respondents are displayed in Table 3.

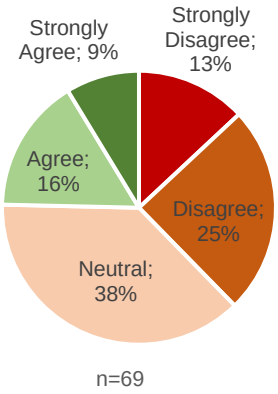

Figure 23. Level of agreement on the availability of practical information

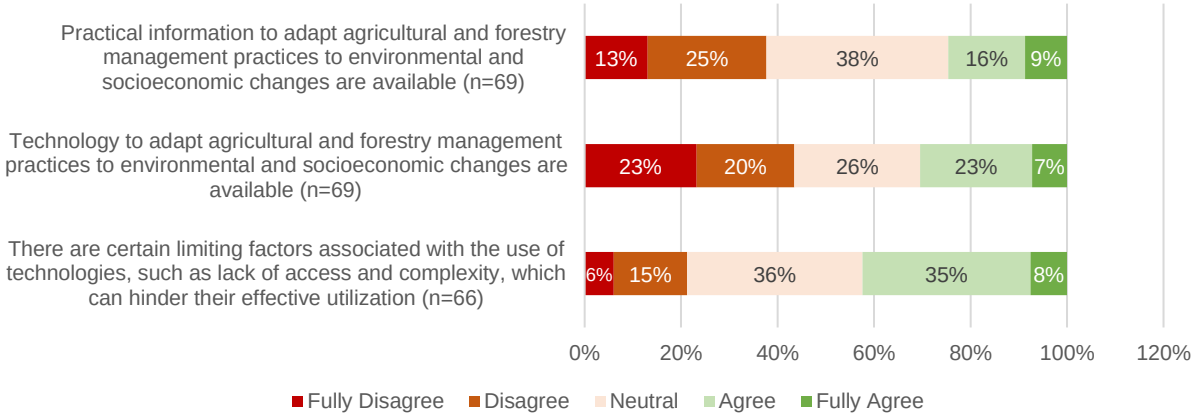

Figure 24. Level of agreement on the survey affirmations regarding the adaptation of management practices to envirnonmental/socioeconomic changes

Knowledge and technology needed
Wood market and centralized prices
Effects of drought on the conservation status of wetlands
Gaming applications
Characterization of the water requirements of the different species and varieties
Data on dynamic risk assessment at the investment level and at the market level
Knowledge of the impact of prescribed burning on soils and biodiversity
Humidity sensors for soil water control
Production prediction data with dynamic assumptions based on climate data
Stationary climate data including weather
Organised training of stakeholders and support for the value chain of maintain grazing livestock products at municipal and regional level
Best practices for smaller owners
Other measures /technical, built/ would improve the health of the forests
Which additional forest species would improve the health in changing environment
Protecting the land from erosion
APSIM
Flora
Underground water resources (quality)
Available water
Permitted crops
Remote Sensing

Table 3. Knowledge and technology advancements necessary to improve the situation regarding the impacts of environmental/economic changes on the activities

A percentage of 38% of the respondents indicates the **absence of research and development** (R&D) **programs** in their respective territory supporting their activities. Another 47% indicates that despite their present, they are insufficient. 50% of the respondents indicate that these programs only partially include empirical cultural practices and another 34% responded that they are insufficiently included despite their presence (Figure 25 and 26). Table 4 offers a qualitative overview of the research needs indicated by the survey respondents.

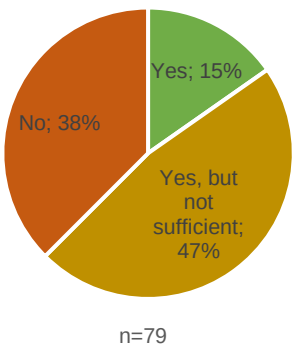

Figure 25. Support from Research and Development programs

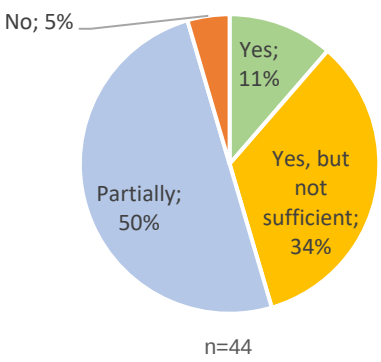

Figure 26. R&D programs including cultural practices

Research needed
Selection of drought resistant species/varieties to adapt to changing conditions
Firewalls, agroforestry mosaics to decrease fire intensity
Drought impact of breeding practices on biodiversity
Impact of burning
Infiltration and evaporation of water in the forest and planting density
The management of uncertainty in the implementation of development policies highly impacted by CC
Effects of vegetation on soil erosion
Characterization of investment levels with low risks
Revision of catalogues relating to cultural and silvicultural practices and techniques taking into account new climatic trends
Updating the definition of appropriate forms of land use
Damage from the lack of silvicultural management of anthropized forest areas
Composting and mulching, the use of forest biomass
Feasibility study
Correlation of the agricultural and silvicultural scale with the climatic scale
Look for drought-resistant plants
Effects of climate change
Conservation agriculture
Development of ancient agriculture
Changing nurseries
Creating a national website via Net
Seed quality
Water exploration

Table 4. Research necessary to improve the situation regarding the impacts of environmental/economic changes on the activities

While 19% of the respondents affirms the **presence of a regional strategy** or local/sectoral plan to adapt to the changing environmental conditions, 34% indicate not knowing of their existence and 46% states their non-existence (Figure 27). Table 5 provides an overview of the action plan and policy measures needed to improve the situation regarding the impacts of environmental/economic changes on the activities, according to the survey respondents.

Furthermore, one third of the respondents affirm the **non-existence of financial support** or subsidies to help their activity cope with environmental and economic changes. Another 51% says they have access to them, but they are not sufficient. Only 7% indicated having access to sufficient financial support to keep up with their activity despite the increased costs to cope with environmental changes (Figure 28). A large portion of the respondents indicate the absence of specific financial instruments, tools, or incentives that support the adoption of good practices in response to changing environmental and economic conditions while indicating their need to be developed (50%) (Figure 29). Another 29% says they exist but are insufficient. A limiting factor to the access of financial support confirmed by 87% of the respondents are often complicated or excessive bureaucratic procedures (Figure 30). Table 6 displays the financial support measures identified by the survey respondents with the potential to reduce the impact of environmental and economic changes on the activities.

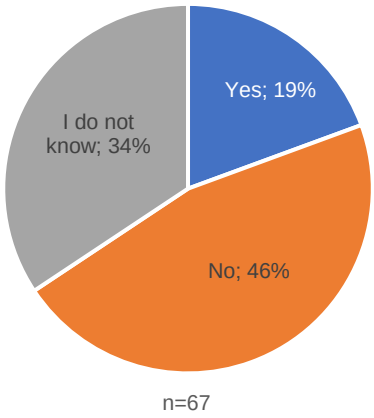

Figure 27. Existence of regional strategy or local/sectoral plan to adapt good practices to cope with environmental/economic changes

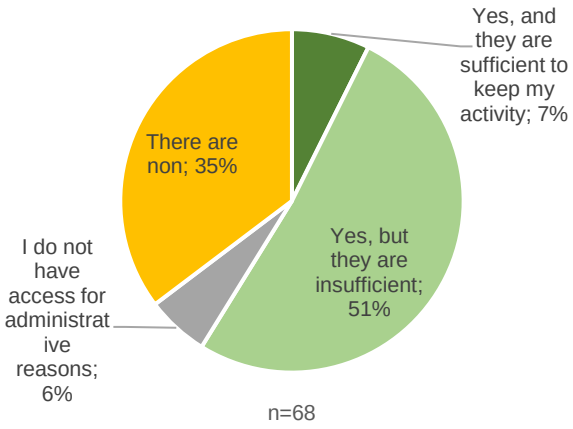

Figure 28. Access to financial support/subsidies to help your activity and/or to cope with environmental/economic changes

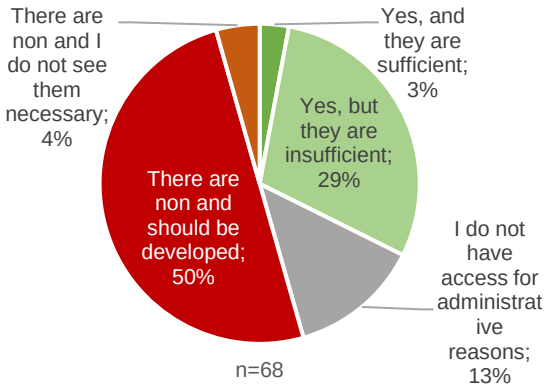

Figure 29. Availability of specific financial instruments, tools, or incentives to support the adoption of good practices in response to changing environmental/economic

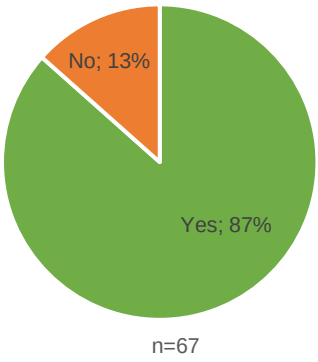

Figure 30. Difficulties of bureaucracy procedures and/or excessive to have access to financial support

Action plan or policy measure needed
Modify the cadaster / land classification to incorporate the agroforestry systems land use
Combat forest abandonment by simplifying the bureaucracy, facilitate the possibility to apply fire-prevention silviculture in abandoned forests and make the owners legally responsible of any impact caused when they refuse to have a free silvicultural intervention
Improve the subsidy framework for agroecological practice
Adapt the sanitary livestock regulations, simplifying the requirements in extensive grazing. The rules are currently similar for intensive and extensive systems.
Assessment of climate risks and their possible small-scale manifestation
Assessment of the direct and indirect impacts of climate change on the social dynamics of each climatic region
Regional plan for CC mitigation and adaptation
Updatable risk valuation and zoning allocation plan
Create relevant educational subjects
Facilitating activities for new farmers

Increasing quality for new farmers
Long term programmes
The ability of seeds to adapt
The necessity of exploiting all lands and legalizing the matter
Water resources exploitation strategy

Table 5. Action plans or additional policy measures necessary to improve the situation regarding the impacts of environmental/economic changes on the activities

Financial measure needed
Investment in raw material transformation infrastructures more adapted to industry requirements
Electronic file to combat delays
Contract shepherds as a professional service against forest abandonment
Subsidies to forest management application and silvopastoralism against forest abandonment
Eco-conditionality of all public aid to combat biodiversity loss
Aids for doing cultivation tests to enable the implementation of new species and varieties adapted to climate changes
Improve the subsidy framework for agroecological practices
Agricultural loans
Climate insurance to be developed
Credit
Direct support in implementing programmed plans
Establishment of climate support and solidarity funds across complementary climatic regions
Flexibility in access to financing from banks with a state guarantee
Grants and vouchers
Insurances
Loans
Systems for compensating direct losses due to climatic hazards
Providing free guidance and veterinary services
Agricultural loan without bank interest
Grant and reward
Granting compensation for losses
Soft loans
Support deep well drilling
Support for seedlings and seeds

Table 6. Financial measures necessary to improve the situation regarding the impacts of environmental/economic changes on the activities

4 How to reinforce resilience in Mediterranean agricultural and forestry activities

This chapter includes the main conclusions based on the survey results. They are organized in four sub-chapters according to the thematic areas defined into the project: management practices, technology, governance and finance.

4.1 Management practices

Integrated agriculture and forestry **management practices** have the power to enhance landscape resilience. Understanding the principal gaps in their application and the benefits they offer is essential, also considering the level of awareness, the access and transfer of information and knowledge necessary for their effective implementation. Management practices also include practices directly associated with disaster management, i.e., prevention and preparedness, detection and response, and restoration and adaptation processes that are considered effective when building responsiveness to disasters. Additionally, there are adaptive management practices that depend on the capacity and availability of current land uses to change. Some examples of practices include, agroforestry, sustainable and regenerative agriculture, sustainable forest management and permaculture.

Respondents of the survey have identified **specific research needs** to adapt their management practices to the challenges they face. For instance, to facilitate adaptation to climate change, research is required on the effects of climate change and updating definitions of appropriate land use forms specific to each territory. Additionally, there is a need for revising cultural and silvicultural practices and techniques considering new climatic trends, as well as managing uncertainty in policy implementation highly impacted by climate change.

Droughts, identified through the survey as one of the main impacts of climate change, leads to specific research needs, for example to provide guidance in the selection of drought-resistant species and varieties and to help understand the impact of drought on biodiversity breeding practices. Additionally, research on the impact of burning as a cause of drought comes out as essential. Considering wildfires as one of the extreme events most impacting to surveyed activities, research is needed on implementing firebreaks and the effect of agroforestry mosaic landscapes on wildfire prevention. Furthermore, finding an optimal planting density to allow for water infiltration and evaporation in forests and its connection to drought impacts and wildfire risk requires investigation. Respondents are also interested in studying the effect of vegetation on soil erosion.

Additionally, a **variety of research needs** emerged concerning various management practices, particularly in conducting feasibility studies for new implementations. These practices encompass increased biomass utilization for composting and mulching, implementing conservation agriculture, best practices for small owners, adapting nurseries and different seed qualities, developing ancient agricultural practices, exploring the potential benefits of increased silvicultural management and managed forest areas, understanding the correlation of agricultural and silvicultural scales with the climatic scale, and finding adapted management practices involving low-risk investments.

4.2 Technology

Barriers in the update of beneficial management practices prevail due to the lack of awareness and use of **technology**. In the recent years, regional and local public institutions, universities, spinoffs, and startups have researched, developed, and tested different technologies and information infrastructures and solutions on disaster management and warning, based on the use of, for example, satellite imagery, mapping and remote sensing coupled with disaster sensory systems. Several obstacles are prevalent for the adoption of technology and innovation solutions. Some of these include system and feedback complexity; high burden of proof (acceptability) among various relevant sectors/stakeholders; technology readiness level (TRL); dissemination and access to research, innovations, and technology; alignment of solutions with practitioner needs. Similarly, these factors also inhibit the sustainable and practical uptake of outputs of European funded projects.

Survey respondents have identified **specific knowledge transfer** and **technology needs** to adapt their management practices to the challenges they face, particularly related to climate change impacts. For instance, effective monitoring of droughts effects on wetland conservation status, characterization of water requirements of the different species and varieties, and access to humidity sensors to control soil water content are mentioned, given the global water shortages exacerbated by lower rainfall regimes in the Mediterranean region. Tools providing stationary weather and climate data, as well as production prediction data based on dynamic assumptions from climate data, would facilitate climate change adaptation. Additionally, for the implementation of sensitive management practices like prescribed burning, knowledge transfer on its impact on soils and biodiversity is crucial.

Respondents highlight mapping technologies, remote sensing, and production system simulators such as APSIM as potentially valuable technological tools. Valuable knowledge transfer includes information on permitted crops, water availability in underground water resources and their quality, erosion protection techniques, flora adapted to changing conditions, and measures to improve forest health.

Limiting factors of existing technologies were identified that need consideration for further development and optimization. A major one when dealing with climate change impacts is climate uncertainty and the occurrence of unpredictable phenomena like earthquakes, the 2023 High Atlas earthquake in Marocco taken as an example. Respondents consider some existing technologies inaccessible or unadapted to small owners, due to high costs and a lack of market for technology rental or associated services. Further limitations include poor return value of products compared to costs, poor ease of use of new technologies, lack of attractiveness of technological tools for specific audiences, and ignorance of technology availability. Some technologies or information support systems may be inaccessible for remote territories such as mountain farmers in Greece.

4.3 Governance

Poor **governance** is also a major factor contributing to barriers within the processes that facilitate and support the uptake and application of beneficial management practices. Lack of stakeholder engagement, complex and resistant land access issues, overlapping legislative frameworks, and inadequate information exchange, engagement, and governance around authorities' responsibilities, use and property rights regimes, have contributed to land abandonment and poor land management decisions. These barriers have also hindered the adoption of more innovative and integrated approaches to land management.

Survey respondents have identified **action plans** or **policy measures needed** in response to the challenges they face. Remedying the absence of agroforestry land classification requires modification of the cadastre to incorporate it. Implementation of territorial planning involving updatable risk valuation and zoning allocation plans, as well as regional plans for climate change mitigation and adaptation, is also necessary. Respondents also mentioned the need to improve the subsidy framework for agroecological practices and to simplify the sanitary livestock regulations to promote extensive farming systems which will allow for more extensive grazing. Additionally, facilitating activities, access to more exploitable lands, and increasing the quality of life for new farmers are essential in addressing land and forest abandonment. Effective governance of available global resources entails defining a water resource exploitation strategy and assessing direct and indirect climate change impacts on the social dynamics of each climatic region, including possible small-scale manifestations in terms of risks.

Respondents highlight **other aspects** to be included in good governance practices, such as long-term programs to ensure meeting sustainability objectives, improving competitiveness of certain markets through centralized pricing, supporting value chains stemming from good practices like products from grazing livestock, organizing stakeholder trainings, and ensuring support from various administrative levels. Simplification of bureaucracy is considered essential, for example, to facilitate the application of fire-prevention silviculture in abandoned forest plots, which would help establish legal responsibility for any impacts caused by refusal of intervention. Creating relevant educational subjects may further support implementation efforts.

4.4 Finance

Emerging **financial** instruments and solutions like microfinance, insurance and blended finance, green bonds as well as alternative or supplementary income sources such as payment for ecosystem services, are often unknown, misunderstood and perceived as very complex by landowners. Nevertheless, these financial instruments can have a determining role when it comes to the successful implementation of adaptation measures in response to climate or socio-economic changes affecting agriculture and forestry activities and facilitating the transition to more resilient landscapes.

Respondents of the survey have identified **specific financial needs** corresponding to the challenges they face. For instance, to combat forest abandonment, a respondent suggested contracting shepherds as a professional service and providing subsidies for forest management and silvopastoralism activities. Addressing biodiversity loss could involve integrating eco-conditionality into all public aid. Similarly, adaptation to climate change may require support for cultivating new species or varieties adapted to changing conditions and drilling deep wells to mitigate drought challenges.

A variety of **financial instruments and solutions** have been proposed to address these needs, including soft loans with reduced bank interest rates, credits, climate insurance systems, grants and rewards, vouchers, access to financing from banks with state guarantees, direct compensations for losses, improved subsidy frameworks for agroecological practices, provision of free guidance and support services (such as veterinary

services or provision of new seedlings and seeds) for implementing planned activities, and establishment of solidarity funds across complementary climatic regions.

Survey respondents involved in agricultural and forestry activities encounter various **limiting factors** concerning financial instruments. Addressing these limiting factors is essential for designing financial instruments that effectively support the diverse needs of agricultural and forestry activities. One significant obstacle is the requirement for co-financing, which often limits access to financial assistance. Additionally, tight deadlines, excessive bureaucracy, and extensive information requirements make it difficult for respondents to adhere to prescribed timelines, thereby impeding their access to financial support. The complexity of legislation further adds to the challenges, creating confusion and hindering navigation of financial instruments. Moreover, the involvement of multiple entities for opinions adds another layer of complexity and consumes valuable time and resources. Instruments with overly complex constraints pose further barriers to accessing financial assistance. Despite the availability of financial support instruments, some delays in receiving financial assistance and long lead times still hinder the timely implementation of agricultural or forestry activities. In some Mediterranean regions, delays may be exacerbated by outdated analogue paperwork processes, suggesting a transition to electronic files as a potential solution. Furthermore, financial support tools often comprise insufficient funding, constraining the respondents' activities. They may also inadvertently favour large-scale production or established companies, leading to bias and unfair disadvantage for those engaged in non-conventional farming practices. Similarly, the lack of flexibility in funded actions and uncertainty in scoring criteria hinder adaptability to diverse agricultural or forestry practices. The effectiveness of financial support programs is further reduced by inadequate training and motivation among public administration personnel, including technicians and policymakers. This shortfall undermines the efficient implementation of financial support programs. Lastly, investments in transformation infrastructures tailored to industry requirements can facilitate the adaptation process to new technologies.

5 Final remarks

According to the survey results, there is clear **evidence** of a **warming climate trend** resulting in droughts, heatwaves, and wildfires as the most impactful extreme events in terms of frequency, intensity, and their effects on agricultural and forestry activities. Concurrently, the respondents highlighted a decrease in cold waves, along with below average rainfall and changes in its distribution. Therefore, an increase in extremes, particularly inclined towards warmer and drier conditions, is perceived.

A **link** has been identified between **socioeconomic factors** affecting activities and **environmental** conditions. For example, urban/industrial development and competition for water can be directly related to droughts, leading to increased tension as conditions worsen, becoming drier. **New solutions** should address these predictable situations, focussing on maintaining activities with the same or increased needs but fewer resources available (e.g., equal water needs while there is less availability). Regarding the socioeconomic factors with less impact (such as the development of renewable energy, or recreation activities in the area), they can be seen either as novel factors which may become significant in the future, or as more area specific factors compared to others, naturally leading to less responses indicating their negative impacts. In this regard, it can be considered that the valuation of socioeconomic factors is directly related to their **territorial distribution**. For example, the lack of political stability and long-term policies are highlighted as the main factors affecting the surveyed activities, affecting all territories, regardless of their specific conditions. However, factors like illegal harvesting on properties, marked as the least impacting factor, have uneven effects across the territories.

Despite attempts to link different variables, **no evident pattern** has been found between the **responses** and specific **countries**. In other words, responses are not clearly represented by one or a group of countries. Considering the limitations of the sample, it can be interpreted that the identified challenges are shared at Mediterranean level.

Enhancing resilience in Mediterranean agricultural and forestry activities requires a **multifaceted approach** that addresses various challenges posed by environmental and socio-economic changes. Some of the **strategies** to reinforce resilience can address:

- Diversification of crops and tree species: cultivating a variety of crops and tree species that are adapted to local conditions can help mitigate risks associated with climate variability and pests/diseases.
- Soil and water conservation techniques: implementing practices such as contour plowing, terracing, mulching, and drip irrigation can help conserve soil moisture and prevent erosion, thereby enhancing water availability and soil fertility.
- Agroforestry and Silvo pastural systems: integrating trees into agricultural and pastoral landscapes can provide multiple benefits, including shade, windbreaks, soil stabilization, and additional sources of income through timber, fruits, and fodder production.
- Sustainable land management practices: adopting sustainable land management practices such as agroecology, conservation agriculture, and holistic grazing management can improve soil health, increase water infiltration, and enhance ecosystem resilience.
- Community-based approaches: encouraging community participation and collaboration among farmers, foresters, researchers, and policymakers can foster knowledge sharing, collective decision-making, and adaptive management of natural resources.
- Capacity building and education: providing training and extension services to farmers, forest owners, and rural communities on climate-smart practices, adaptive strategies, and risk management techniques can enhance their resilience to environmental stresses.
- Policy support and incentives: implementing supportive policies, regulations, and incentives that promote sustainable land use practices, agroecological farming systems, and investment in climate-resilient infrastructure can create an enabling environment for building resilience in agricultural and forestry sectors.

By integrating these strategies into agricultural and forestry activities, stakeholders can enhance their capacity to cope with climate variability, water scarcity, and other environmental challenges, thereby promoting sustainable development and resilience in the Mediterranean region.

Responding to the diverse needs in terms of finance, technology, management practices, and governance across different territories and activities is crucial for facilitating the adaptation of land management practices. In terms of overcoming current **limiting factors**, there is a need to address issues such as lack of awareness of available technological tools, high costs, and complexity in usage. Similarly, improving management practices requires societal acceptance of change, and overcoming the lack of knowledge transfer regarding environmental impacts, and diverse constraints in implementation efforts. In terms of finance, the main highlighted factors are complex bureaucratic processes the overall limited available funding. Furthermore, effective governance is impeded by intricate and overlapping regulatory frameworks, along with the involvement of numerous actors within the sector.

Concerning **new developments**, there is a need for the development of technology, including access to effective monitoring and measuring tools, weather and climate predictions, and mapping technologies. In management practices, there is a need to promote and facilitate alternative approaches such as agroforestry, accompanied by adequate knowledge provision. In finance, instruments supporting small property owners and agroecological practices, along with simplification of bureaucratic processes and funding mechanisms to enhance access to technology and support innovative approaches are essential. Governance improvements include creating relevant education programs, enhancing legal frameworks to accommodate new management practices, assessing direct and indirect climate change impacts, and implementing long-term sustainability programs.

By addressing these needs and advancing new developments, the adaptation of land management practices can be effectively facilitated, contributing to resilience in the face of changing environmental and socioeconomic conditions.

ResAlliance

ANNEX I. Complete survey

Contribution ID: f46753a5-e3c7-41e3-8fb3-5276979f9168
Date: 11/01/2024 13:26:11

Survey on Mediterranean-wide landscape needs

Fields marked with * are mandatory.

ResAlliance

Dear participant,
The objective of the survey is to evaluate and comprehend the principal needs, barriers, gaps, and potential solutions that stakeholders from the agricultural and/or forestry sectors in the Mediterranean basin may have in conducting their activities amidst current and future changes in land use, socioeconomic factors, and the environment. Both external and internal conditions are impacting the viability of these activities, as well as the ability to adapt and recover from disturbances caused by natural hazards and other socioeconomic impacts.
The survey aims to explore how to reinforce agricultural and forestry activities in the Mediterranean under the frame of landscape resilience, understood as the ability of a landscape to sustain its range of natural and human-related functions and processes over time under changing conditions, and despite multiple stressors and uncertainties.
This survey could take around 40 minutes to complete.
Responses will be anonymized and analysed in the context of the ResAlliance project.
If you want to be updated on the results, please indicate so at the end of the survey and leave your email address.

* **CONSENT**

Your participation in this survey is voluntary. If you decide to participate, you may withdraw at any time.
This survey is anonymous. It does not collect any personal information and you cannot be identified through your responses. The data collected will be securely stored and the access to it will be restricted to authorised personnel from the ResAlliance project.
Please, from the options below, select the ones that you agree with:

- [x] I have read and understand the information above
- [ ] I voluntarily agree to participate in this survey
- [x] I am over 18 years old

SECTION I - PROFILE, FIELD OF ACTIVITY AND SITE

This section aims to identify your main sector(s) of activity, your professional profile, your age range, years of experience and territory.

I.1 Sector of activity

Main sector of activity

- [ ] Agriculture
- [ ] Forestry
- [ ] Livestock
- [x] Other agro-forestry
- [ ] Apiculture
- [ ] Management of protection forest, fire prevention, and forest health
- [ ] Management of protected areas
- [ ] Eco-tourism
- [ ] Other

Other agro-forestry (please specify the agro-forestry system if is different from silvopastoral mentioned before):

I.2 Profile and site

* Profile

- [ ] Farmer
- [ ] Shepherd
- [ ] Forester
- [ ] Technician from Agriculture extension services
- [ ] Technician from Forest administration
- [ ] Technician from private company providing agricultural services
- [ ] Technician from private company providing forestry services
- [x] Manager of protected areas
- [ ] Policymaker
- [ ] Trainer/professor at a professional school
- [ ] Staff from an applied research institute working with farmers and foresters
- [ ] Other

Age

- ( ) 18-30
- ( ) 31-45
- ( ) 46-60
- ( ) Over 60

Gender

- ( ) Male
- ( ) Female
- ( ) Non-binary

- Prefer not to say

Years of experience within your sector

- 0-3
- 4-9
- 10-14
- 15-24
- More than 25

* Country

asas

Region

City

SECTION II - RELATED CLIMATE CHANGE AND LAND USE CHANGE SCENARIOS IMPACTS ON YOUR ACTIVITY

This section aims to identify the main impacts, that could directly or indirectly be related to climate change scenarios, affecting your activity.

II.1 Frequency and intensity of the changes in climate and weather

Please, indicate up to what extent do you consider the following environmental disturbances/conditions are happening (e.g., comparing the last 15-20 years or the period you have experience on, with previous time).

Change in meteorological/climate patterns/environmental conditions

Unusual high temperatures periods out of the season (from Autumn to Spring)

Frequency: *In a scale from 1 to 5, being 1 "Much less frequent", 3 "As usual" and 5 "Much more frequent".*
Intensity: *In a scale from 1 to 5, being 1 "Much less intense", 3 "As usual" and 5 "Much more intense".*

	1	2	3	4	5
Frequency	◉	○	○	○	○
Intensity	○	○	○	○	○

Unusual low temperatures periods out of the season (from Spring to Autumn)

	1	2	3	4	5

Frequency	○	◉	○	○	○
Intensity	○	○	○	○	○

Temperatures above average

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	◉	○	○	○

Temperatures below average

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	◉	○	○	○

Changes in rainfall distribution

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	○	○	○	○

Rainfall below average

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	○	○	○	○

Rainfall above average

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	○	○	○	○

Windy days above average

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	○	○	○	○

Windy days below average

	1	2	3	4	5

Frequency	○	○	○	○	○
Intensity	○	○	○	○	○

Sea level rise

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	○	○	○	○

Salinity

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	○	○	○	○

Soil degradation

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	○	○	○	○

Other (please specify):

Extreme events

Windstorms

Frequency: *In a scale from 1 to 5, being 1 "Much less frequent", 3 "As usual" and 5 "Much more frequent".*
Intensity: *In a scale from 1 to 5, being 1 "Much less intense", 3 "As usual" and 5 "Much more intense".*

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	○	○	○	○

Hailstorms

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	○	○	○	○

Pest and diseases

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	○	○	○	○

Drought

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	○	○	○	○

Floods

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	○	○	○	○

Wildfires

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	○	○	○	○

Heat waves

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	○	○	○	○

Cold waves

	1	2	3	4	5
Frequency	○	○	○	○	○
Intensity	○	○	○	○	○

Other (please specify):

II.2 Which of the above-mentioned changes in climate or meteorological conditions negatively impact your activity the most (and how)

Please, indicate up to what extent you consider the following environmental disturbances/conditions are affecting your activity.

Change in meteorological/climate patterns/environmental conditions

In a scale from 0 to 5: being 0 "Not happen", 1 "Very low impact" and 5 "Very high impact".

Level of impact	0	1	2	3	4	5
Unusual high temperatures periods out of the season (from Autumn to Spring)	○	○	○	○	○	○
Unusual low temperatures periods out of the season (from Spring to Autumn)	○	○	○	○	○	○
Temperatures above average	○	○	○	○	○	○
Temperatures below average	○	○	○	○	○	○
Changes in rainfall distribution	○	○	○	○	○	○
Rainfall below average	○	○	○	○	○	○
Rainfall above average	○	○	○	○	○	○
Windy days above average	○	○	○	○	○	○
Windy days below average	○	○	○	○	○	○
Sea level rise	○	○	○	○	○	○
Salinity	○	○	○	○	○	○

Other change in meteorological/climate patterns/environmental conditions (please specify):

Specify, if needed, the sector/subsector of activity:

In case you have chosen more than one activity in section I.1, would you like to answer from the perspective of another activity?

- ○ Yes
- ○ No

Extreme events

In a scale from 0 to 5: being 0 "Not happen", 1 "Very low impact" and 5 "Very high impact".

Level of impact	0	1	2	3	4	5
Windstorms	○	○	○	○	○	○
Hailstorms	○	○	○	○	○	○

Pest and diseases	○	○	○	○	○	○
Drought	○	○	○	○	○	○
Floods	○	○	○	○	○	○
Wildfires	○	○	○	○	○	○
Heat waves	○	○	○	○	○	○
Cold waves	○	○	○	○	○	○

Other extreme events (please specify):

In case you have chosen more than one activity in section I.1, would you like to answer from the perspective of another activity?

- ○ Yes
- ○ No

Other indirect impacts of meteorological/climate changes

Other impacts on the ecosystem affecting your activity such as exotic animal/plant species invasion, etc. (please specify):

Is your activity (indirectly) affected by measures and policies related to climate change scenarios (e.g., cereal harvesting prohibition or access restrictions to forest massif due to high wildfire risk, irrigation limitations, cultural fire use limitations due to air quality restrictions, etc.)? Please, describe how you are impacted:

II.3 Existing or potential land-use changes and global socioeconomic factors affecting your agricultural/forestry activity

Please, globally indicate how the following factors may affect the viability of your activity if this is the case.

Impacting factor

In a scale from 0 to 5: being 0 "Not happen", 1 "Very low impact" and 5 "Very high impact".

Level of impact	0	1	2	3	4	5
Urban/industrial development and competition for land	○	○	○	○	○	○
Urban/industrial development and competition for water	○	○	○	○	○	○
Renewable energy development and competition for the land	○	○	○	○	○	○

Increase of recreation activities disturbing livestock and pastures	○	○	○	○	○	○
Increase of wild fauna	○	○	○	○	○	○
Illegal harvesting on my properties	○	○	○	○	○	○
Lack of political stability and long-term policies	○	○	○	○	○	○
Competition of EU markets	○	○	○	○	○	○
Competition of other international markets	○	○	○	○	○	○
Restrictions related to protected areas	○	○	○	○	○	○
Lack of skilled workforce	○	○	○	○	○	○
Unsuitable infrastructures	○	○	○	○	○	○
Change of activities	○	○	○	○	○	○
Increased poverty and rural depopulation	○	○	○	○	○	○
Supply chain disruptions	○	○	○	○	○	○

Other impacting factor (please specify):

In case you have chosen more than one activity in section I.1, would you like to answer from the perspective of another activity?

- ○ Yes
- ○ No

SECTION III - MANAGEMENT PRACTICES IN AGRICULTURE AND FORESTRY, PRESENT AND FUTURE

This section aims to explore the current global challenges in land management and how we can better prepare for the future while ensuring the continuity of agriculture and forestry practices.

III.1 Management practices feasibility and challenges

Please, indicate to what extent the following tools are currently available to you and up to what extend they have the potential to make your activity more viable and competitive.

Supporting tools

Support from agriculture/forestry extension services

Degree of development: *In a scale from 1 to 5, being 1 "Are missing" and 5 "They are in place and well developed".*
Impact on the activity: *In a scale from 1 to 5, being 1 "Not affecting" and 5 "Highly improving feasibility".*

	1	2	3	4	5
Degree of development	○	○	○	○	○
Impact on the activity	○	○	○	○	○

Agricultural cooperative/forestry association

	1	2	3	4	5
Degree of development	○	○	○	○	○
Impact on the activity	○	○	○	○	○

Access to training programs

	1	2	3	4	5
Degree of development	○	○	○	○	○
Impact on the activity	○	○	○	○	○

Access to exchange programs (visit another place to learn about new or different technologies)

	1	2	3	4	5
Degree of development	○	○	○	○	○
Impact on the activity	○	○	○	○	○

Agricultural/forestry insurance systems

	1	2	3	4	5
Degree of development	○	○	○	○	○
Impact on the activity	○	○	○	○	○

Affiliation to agricultural/forestry trade unions

	1	2	3	4	5
Degree of development	○	○	○	○	○
Impact on the activity	○	○	○	○	○

Maintenance of price stability

	1	2	3	4	5
Degree of development	○	○	○	○	○
Impact on the activity	○	○	○	○	○

Measures to improve access to the international market

	1	2	3	4	5
Degree of development					
Impact on the activity					

Measures to improve access to the national market

	1	2	3	4	5
Degree of development					
Impact on the activity					

Promotion of local market and consumption of local products

	1	2	3	4	5
Degree of development					
Impact on the activity					

Transport infrastructures

	1	2	3	4	5
Degree of development					
Impact on the activity					

Institutions of research and innovation

	1	2	3	4	5
Degree of development					
Impact on the activity					

Traditional knowledge (empirical cultural practices (traditional practices based on your or your ancestors' experience))

	1	2	3	4	5
Degree of development					
Impact on the activity					

Professional schools

	1	2	3	4	5
Degree of development					
Impact on the activity					

Knowledge transfer from universities and research institutions

	1	2	3	4	5
Degree of development	○	○	○	○	○
Impact on the activity	○	○	○	○	○

Size of the property/land management unit

	1	2	3	4	5
Degree of development	○	○	○	○	○
Impact on the activity	○	○	○	○	○

Joint/grouped land management

	1	2	3	4	5
Degree of development	○	○	○	○	○
Impact on the activity	○	○	○	○	○

Existence of local products processing industries

	1	2	3	4	5
Degree of development	○	○	○	○	○
Impact on the activity	○	○	○	○	○

Contingency plans for recovery after disasters and emergency relief payments

	1	2	3	4	5
Degree of development	○	○	○	○	○
Impact on the activity	○	○	○	○	○

Financial support to the activity (e.g., RDP measures, environmental bonus, etc.)

	1	2	3	4	5
Degree of development	○	○	○	○	○
Impact on the activity	○	○	○	○	○

Financial facilitation of loans and investments (reduced access costs or taxes/tariffs; informed bank staff; reduced bureaucracy, etc.)

	1	2	3	4	5
Degree of development	○	○	○	○	○
Impact on the activity	○	○	○	○	○

Please, describe any other aspect that you see fundamental to make your activity more viable (in your daily activity and/or after suffering a disaster) that you miss or should be better developed:

Please indicate to what extent the following aspects pose challenges to your daily activities and their continuity:

In a scale from 1 to 5, being 1 "Not affecting" and 5 "High limitation".

Challenges	1	2	3	4	5
Lack of technical innovation due to limited investment capacity	○	○	○	○	○
Lack of management innovation due to lack of access to new knowledge and practices	○	○	○	○	○
Cultural difficulties on changing traditional practices and updating them	○	○	○	○	○
Inadequacy of traditional management practices (e.g., type of crops) to new environmental conditions	○	○	○	○	○
Lack of financial capacity to adequate the activity to the new environmental conditions	○	○	○	○	○
Lack of alternative management practices to adequate the activity to the new environmental conditions	○	○	○	○	○
Lack of financial capacity to cope with the economic losses of extreme events	○	○	○	○	○
Lack of financial capacity to adopt the needed measures to cope with extreme events (e.g., installing hail resistant net, changing the irrigation system, etc.)	○	○	○	○	○
Managerial difficulties on adopting all legal requirements	○	○	○	○	○
Financial difficulties on adopting all legal requirements	○	○	○	○	○
Managerial limitations due to environmental regulations	○	○	○	○	○
Lack of adequacy of laws and regulations to the practical situation on the ground	○	○	○	○	○
Excessive bureaucracy and administrative formalities	○	○	○	○	○
Lack of adequacy of administrative procedures with the management practices calendar on the ground	○	○	○	○	○
Unproper definition of property rights	○	○	○	○	○
Limited access to the land	○	○	○	○	○
Lack of family farming business continuity with the children/younger generations	○	○	○	○	○
Difficulties on incorporation of new farmers	○	○	○	○	○

Lack of skilled workers	○	○	○	○	○
Lack of economic profitability of the activity	○	○	○	○	○

Please specify any additional challenges not mentioned above that significantly limit your current activities or may impact the continuation of your activities in the future:

III.2 Adaptation of management practices to environmental/socioeconomic changes

Have you felt forced to change any agricultural/forestry practice as a result of environmental/socioeconomic changes?

- ○ Yes
- ○ No
- ○ I am not sure

What additional management practice would you consider necessary to improve your situation regarding the impact of environmental/economic changes on your activities?

Please, link each need to a concrete impact.
Needs can be mentioned without a related impact.

	Impact	Management practice need
1		
2		
3		
4		
5		

To complement your previous answers, please indicate the extent to which you agree with the following:

In a scale from 1 to 5, being 1 "Fully disagree" and 5 "Fully agree".

	1	2	3	4	5
Practical information to adapt agricultural and forestry management practices to environmental and socioeconomic changes are available	○	○	○	○	○
Technology (maps, GPS, mobile apps, drones, Smart agriculture, etc.) to adapt agricultural and forestry management practices to environmental and socioeconomic changes are available	○	○	○	○	○
There are certain limiting factors associated with the use of technologies, such as lack of access and complexity, which can hinder their effective utilization	○	○	○	○	○

Please describe which information, knowledge and/or technology you are using to cope with the environmental/economic changes affecting your activity and how:

Please indicate what information, knowledge or technology you consider is missing and could help to improve your situation regarding the impact of the environmental/economic changes affecting your activity:

Please, link each knowledge or technology need to a concrete impact.
Knowledge or technology needs can be mentioned without a related impact.

	Impact	Knowledge and technology need
1		
2		
3		
4		
5		

III.3 Other tools and capacities to support your activity and to cope with impacts of environmental/economic changes

Are there Research and Development programs in your territory supporting your agriculture/forestry activities?

- Yes
- Yes, but not sufficient
- No

What research would be necessary to provide you with solutions regarding the impacts of environmental /economic changes on your activities?

Please, link each research need to a concrete impact.
Research needs can be mentioned without a related impact.

	Impact	Research need
1		
2		
3		
4		
5		

Is there any regional strategy or local/sectoral plan to adapt good practices to the changing environmental conditions?

- Yes
- No
- I do not know

What research would be necessary to provide you with solutions regarding the impacts of environmental /economic changes on your activities?

Please, link each action to a concrete impact.
Actions can be mentioned without a related impact.

	Impact	Action plan or policy measure needed
1		
2		
3		
4		
5		

Do you have access to financial support/subsidies to help your activity and/or to cope with environmental /economic changes?

- Yes, and they are sufficient to keep my activity
- Yes, but they are insufficient
- I do not have access for administrative reasons
- There are non

Are there specific financial instruments, tools, or incentives available to support the adoption of good practices in response to changing environmental/economic conditions (e.g., resources to facilitate the transition to crop species that are better adapted to warmer conditions)?

- Yes, and they are sufficient
- Yes, but they are insufficient
- I do not have access for administrative reasons
- There are non and should be developed
- There are non and I do not see them necessary

Do you find bureaucracy procedures to be difficult and/or excessive to have access to financial support?

- Yes
- No

What financial tool would you consider to be necessary to improve your situation regarding the impacts of environmental/economic changes on your activities?

Please, link each financial measure to a concrete impact.
Financial measures can be mentioned without a related impact.

	Impact	Financial measure needed
1		
2		
3		
4		
5		

Please provide any additional references to good practices, including traditional practices based on your experience, guidelines, websites, etc., that can help make agriculture and forestry activities in the Mediterranean region more feasible, sustainable, and adaptable to the current changing environmental and economic conditions:

In case you want to provide additional references please upload your file:

Final remarks

If you have any comment or suggestion, you can write them below:

Please indicate if you are interested on receiving the results of the survey when they are edited:

- ○ Yes
- ◉ No

Contact

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