LIFE PASTORALP

ADAPTATION MEASURES

TO CLIMATE CHANGE IN ALPINE PASTURES

Pastures vulnerability and adaptation strategies to climate change impacts in the Alps

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GLOSSARY

24 hours grazing time	Night and day grazing with no return to the barn.
Climbing or Amontagnage	Seasonal, vertical transhumance that takes place in the period of late spring/early summer when cattle and flocks are transferred from the lowlands to the summer mountain pastures.
Coarse vegetation	Graminoid vegetation that is poorly consumed by animals (*Patzkea paniculata, Brachypodium gr. pinnatum, Helictotrichon spp., Deschampsia caespitosa, Calamagrostis spp., etc*).
Downclimbing or Demontagnage	Descent of cattle and flocks from the alpage to the lowlands at the end of summer or in autumn.
Forests suitable for sylvo-pastoral use	Forests suitable for silvo-pastoral use: these are generally even-aged woods characterized by a herbaceous understory, likely rich in grasses and/or legumes and/or a shrub layer having a mid-pastoral value. The main tree species larch forests, secondary broadleaf forests (birch, poplar, invasive maple and ash forests, etc.), swiss scots pine and oak forests rich in grasses and legumes, sometimes fir woods. This category does not entail forests directly protected, stands under regeneration or transformation processes as well as uneven-aged stands at any stage of growth. Beech forests, fir forests, oak-hornbeam forests do not have a particular forestry vocation. In suitable stands, the conditions of the sward, light on the ground and availability for grazing can be improved by thinning, also through the transformation of irregular stands, without any particular management and without any other particular vocations.
High altitude pastoral paddock	Pastures at higher altitudes, usually grazed in August.
Mayen	Mid-mountain pasture, grazed on the way up or down from the summer mountain pasture, thus at the beginning (spring) and end of the grazing period (autumn).
Minor species	Wild minor species – complex of small size species ("minor" doesn't have a biological or systematic meaning) like: amphibians, reptiles, small mammals, fish and insects. Some "minor species" are listed in The Bird (2009/147/EC) and Habitat Directive (92/43/CEE). Directives define the protection level.
Summer mountain pastures or Alpage	The alpage is a high-altitude pastoral unit used in summer by herds and flocks belonging to one or several farmers. Usually the alpine pasture consists of a variable number of pasture areas and huts (remue or tramuto), where the herd and its shepherds stop for the time necessary to consume the surrounding pastures.

THE PROJECT IN BRIEF

PASTORALP (2017-2023) is a project co-financed by the LIFE program aimed at reducing the impacts of climate change on alpine pastures, increasing their resilience and decreasing their vulnerability.

The project relies on a participative approach and a solid science-based knowledge of baseline conditions of Alpine pastoral communities and projected impacts of future climate changes on these communities, with focus on two national parks representative of West's Alpine environments: Parc National des Ecrins (France) and Parco Nazionale Gran Paradiso (Italy).

The PASTORALP platform on the project website was created to support pastoral communities and, in particular, to promote effective and feasible adaptation strategies to cope with socio-economic and climate change. Both policy recommendations to improve decision-making effectiveness in grassland management and the technical measures presented below have been identified.

INSTRUCTIONS

In the two study areas, researchers and stakeholders identified the main climate risks for alpine pastures and the potential impacts on the environment (soil, vegetation and water), animals and the pastoral system.

For each climatic risk, technical adaptation measures were identified in order to maintain forage production, improve water use, optimise animal management on alpine pastures and protect alpine biodiversity.

Particular attention was focused on the factors of failure or success in the application of the measures, the management aspects, the technical difficulties that breeders and shepherds might face and, finally, the preservation of floristic and faunal biodiversity.

CLIMATE RISKS	LACK OF SNOW, DRY WINTER / LATE SPRING OR COLD SPRING / EARLY SNOWMELT FOLLOWED BY SPRING FROST									
CONSEQUENCES ON THE ENVIRONMENT (SOIL, VEGETATION AND WATER) OR ANIMALS	LOW PRODUCTION OF GRASS DUE TO LACK OF WATER OR LOW TEMPERATURES OR GROWTH STOP CAUSED BY FROST									LOW GRASS PRODUCTION AT THE BEGINNING OF THE SEASON AND/OR GRASS TOO TENDER
POTENTIAL CONSEQUENCES FOR THE PASTORAL SYSTEM	POORER PASTORAL RESOURCE IN QUANTITY ON LOW PASTURES (USUALLY MORE PRODUCTIVE) OR DELAYED START OF THE GROWING SEASON							REDUCTION IN QUANTITY AND QUALITY OF GRASS	DEGRADATION OF VEGETATION COMPOSITION	POORER PASTORAL RESOURCE IN QUANTITY ON LOW PASTURES (PRODUCTIVE AREAS) OR DELAYED START OF VEGETATION
ADAPTATION MEASURES	Increase the consumable coarse vegetation or shrubs grazing and supplementary feeding of lactating cows	Reduction of the stocking rate by limiting the number of animals	Reduction of the animal stocking rate by delaying the amontagnage	Search for additional pastures and/or brush clearing on the lower parts of the alpage	Recovery or construction of buildings and infrastructure for underutilized grazing areas	Search for temporary buffer zones outside the alpage	Early démontagnage at the end of the alpage season	Modification of yeaning dates	Change of livestock category, breed or species	Permanent modification of grazing calendar (amontagnage)
MANAGEMENT ISSUES	Beware of a too early climbing towards the highest grasslands because of a lack of grass on low pastures. The use of coarse vegetation is recommended to save grass and for the health of the animals	Not always possible	• Not always possible (e.g. for agro-environmental related obligations, opening of accommodation activities) • Distance of the alpage from the valley floor	• Availability and location of summer mountain pasture facilities and equipments • Good knowledge of the alpage	Have the right to use agricultural land	Distance from the alpage or the farm	Availability of pastures at the valley floor	Not always possible	Radical change in the productive orientation	
BIODIVERSITY CONSERVATION	**Fauna:** direct impact on black grouse, hazel dormhouse and bush or ground nesting birds in spring **Flora:** risk of over-selection by livestock	Positive effect	Positive effect	**Fauna:** subtraction of habitat and food resources (e.g. birds, pollinators, reptile refuge areas)	Positive effect thanks to stoking-rate distribution	**Fauna:** subtraction of habitat and food resources (e.g. birds, pollinators, reptile refuge areas) and competition with wild ungulates	Positive effect			Punctual evaluation based on kind of calendar change (see other strategies)
TECHNICAL ISSUES	Guided grazing or setting up of fenced corrals. If the herd is not used to consuming this type of vegetation, the shepherd's job will be complicated	Observe the grasslands before the amontagnage	Observe the grasslands before the amontagnage	• Difficulties to graze in wooded areas when predators are present • Difficult to find water	Accessibility to pastures	• Find free grasslands • Access to pastures • Fragmentation of properties • Pasture grazing in the forest is not always allowed	Choosing the right démontagnage date	Adapt to the changing yeaning period and the market	Complicated to implement	Realignment of the annual operating calendar of the farms
FACTORS FOR FAILURE OR SUCCESS	• Shepherd skills (training) • Technical support to farmers • Habits of the herd	• Proximity of the farm to the alpage • Possibility of finding other destinations for a part of the herd • Alternative solutions within the farm	• Proximity of the farm to the alpage • Flexibility and stocks on the farm	• Presence of a shepherd's helper • Works and equipment financing	• Works financing • Owners' will • Consent of stakeholders	• Support for pasture search by municipalities • Creation of AFP (pasture landowners association) • Relaunch of grazing in the intermediate areas of mayen	• Farmer consultation • Alternative solutions on the farm	Technical support to farmers in this process	• Market • Shepherd skills (training)	Flexibility of the farm

CLIMATE RISKS	EARLY SPRING		SPRING DROUGHT AND VERY LITTLE SNOW COVER		
CONSEQUENCES ON THE ENVIRONMENT (SOIL, VEGETATION AND WATER) OR ANIMALS	PLANT PHENOLOGICAL STAGE ALREADY ADVANCED AT THE ARRIVAL ON THE ALPAGE		INSUFFICIENT WATER STOCK IN THE SOIL AT THE START OF VEGETATION GROWTH		
POTENTIAL CONSEQUENCES FOR THE PASTORAL SYSTEM	LOWER NUTRITIONAL QUALITY AND PALATABILITY		LOW RESOURCE IN LOW-ALTITUDE RODUCTIVE PASTURES		
ADAPTATION MEASURES	Tight herding in productive grassland and supplementary feeding for lactating cows	Advanced grazing period (exceptional for one year or all years)	Reduce grazing pressure by reducing the period of use of the lowest grasslands. It can be compensated in increasing grazing pressure on forested lowland areas	Delayed or slower démontagnage	Reduction of the stocking rate by limiting the number of animals
MANAGEMENT ISSUES	Difficult to fatten lambs or keep the same milk production with this type of resource	Distance from the alpage or the farm		• Not always possible. • Distance from the alpage or the farm	Not always possible
BIODIVERSITY CONSERVATION	Beware of overgrazing, risk of excessive nitrogen return to the soil. Permanet damage on pasture.	• Direct impacts on ground nesting birds • **Wild ungulates:** impacts on pregnant females or with cubs • **Early pollinators:** subtraction of nectar resources • **Beware of guardian dog:** impacts on marmots (out of hibernation)	**Grazing in the woods:** • **Fauna:** direct disturbance on hazelnuts, Chiroptera, black grouse, woodpeckers, owls • **Beware of guardian dogs:** prey on chicks or young ungulates • **Flora:** must be practice on graminoid herbaceous undergrowth **Caution!** Absolutely avoid grazing in the presence of stone pine regrowth	Positive effect	Positive effect
TECHNICAL ISSUES	In case of high number of lambs, a more suitable vegetation is needed	• Observe the grasslands before the amontagnage • Difficult to combine haymaking and grazing, both advanced	• Identify when grazing has too much impact on the environment • Grazing in the forest is not always allowed	Observe the grasslands before the amontagnage	Observe the grasslands before the amontagnage
FACTORS FOR FAILURE OR SUCCESS	Shepherd permanent presence and skills (training)	• Proximity of the farm to the alpage • Possibility of finding other destinations for a part of the herd	Shepherd skills (training)	• Proximity of the alpage to the farm • Flexibility and stocks on the farm	• Proximity of pastures • Possibility of finding other destinations for a part of the herd • Farmer consultation • Alternative solutions on the farm

CLIMATE RISKS	VERY MARKED DROUGHT IN EARLY SUMMER								HEATWAVES AND WIND AT THE BEGINNING OF SUMMER	
CONSEQUENCES ON THE ENVIRONMENT (SOIL, VEGETATION AND WATER) OR ANIMALS	GRASS THAT DRIES QUICKLY		LOW GRASS PRODUCTION						GRASS REACHING MATURITY AT THE SAME TIME (OR EVEN DRIED) OVER A LARGE PART OF THE SUMMER MOUNTAIN PASTURE	
POTENTIAL CONSEQUENCES FOR THE PASTORAL SYSTEM	NUTRITIONAL QUALITY AND PALATABILITY COULD BE REDUCED		NECESSITY TO RESTORE COMPLEMENTARY GRAZING AREAS AND/OR IMPROVE ANIMAL WELFARE	LACK OF AVAILABLE GRASS. NEGATIVE CONSEQUENCES ON ANIMAL HEALTH AND PRODUCTION					LOWER NUTRITIONAL QUALITY AND PALATABILITY	
ADAPTATION MEASURES	Démontagnage of a part of livestock during the season	For recurring events: reduction of the stocking rate by limiting the number of animals	Pasture restoration and construction or rehabilitation of alpage facilities in new grazing areas. Restoration of mid-mountain pastures (mayen)	Exploration of new pasture areas, including wooded or shrubby areas	Search for buffer areas on lower pastures or on the farm	Storage of forage resources in lowland farm by increasing hay making in marginal areas or by hay purchasing	Fodder supply in alpage for lactating cows	Pastoral utilization of fodder trees, in low-elevation summer mountain pastures	Tight herding in productive grassland and supplementary feeding for lactating cows	Démontagnage of a part of livestock during the season or early démontagnage of all livestock
MANAGEMENT ISSUES	Distance of the alpage from the farm	Beware of overgrazing		Predators: alert for young and little livestock	Distance from the alpage or the farm	Intensification practices on species-rich grasslands			Difficult to maintain the same milk production with this type of resource	Distance of the alpage from the farm
BIODIVERSITY CONSERVATION	Positive effect	Positive effect	• Positive effect thanks to stoking-rate distribution • Monitoring sustainability • Manage direct impacts of operations with mechanical equipment • Respect co-benefits: carbon uptake, water holding capacity	**Grazing in the woods:** **Fauna:** direct disturbance on hazel dormouse, Chiroptera, black grouse, woodpeckers, owls **Beware of guardian dogs:** prey on chicks or young ungulates **Flora:** must be practice on graminoid herbaceous undergrowth **Caution!** Absolutely avoid grazing in the presence of stone pine regrowth	**Fauna:** subtraction of habitat and food resources (e.g. birds, pollinators, reptile refuge areas) and competition with wild ungulates		**Beware of guardian dogs:** prey on chicks or young ungulates. **Caution!** Impacts of fodder transportation	**Habitat trees:** specific protection measures	**Flora:** risk of over-selection by livestock	Positive effect
TECHNICAL ISSUES	A truck is needed to transfer the animals	Agreements between breeders; Possibility of finding other destinations for a part of the herd	• Accessibility • Considerable works	Difficult if predators are present	A truck is needed to transfer the animals	Find complementary hay meadows	• Presence of tracks to access alpages or compensation for helicopter use • Feeding costs and difficulty in calibrating quantity	• Herd size • Distance from broadleaved trees • Elevation • Adapted forest thinning techniques	Good skills in guided grazing are required	A truck is needed to transfer the animals
FACTORS FOR FAILURE OR SUCCESS	Flexibility and stocks on the farm	Water availability	• Funding • Owners' will • Consent of stakeholders	Difficulties in obtaining the necessary permission to use these areas - land management is often complex	Flexibility and stocks on the farm	Improvement of the land context	Availability of hay at the valley floor		Shepherd skills (training)	Flexibility and stocks on the farm

CLIMATE RISKS	VERY HOT AND DRY SUMMER, HEATWAVE AND DROUGHT											
CONSEQUENCES ON THE ENVIRONMENT (SOIL, VEGETATION AND WATER) OR ANIMALS	SOURCE DRYOUT					GRASS THAT DRIES QUICKLY	POSSIBLE DETERIORATION OF VEGETATION COMPOSITION IN THE MEDIUM AND LONG TERM	NEGATIVE EFFECTS OF HEAT STRESS ON ANIMALS	NO REGROWTH ON LOWER GRASSLANDS ALREADY GRAZED AT THE BEGINNING OF THE SEASON			VERY WARM DAYS
POTENTIAL CONSEQUENCES FOR THE PASTORAL SYSTEM	WATERING PROBLEM	WATERING AND IRRIGATION PROBLEM				LOW NUTRITIONAL QUALITY AND PALATABILITY	WORSENING OF THE FODDER RESOURCE	CONSEQUENCES FOR ANIMAL HEALTH, PRODUCTION AND REPRODUCTION	GRASS SHORTAGE AT THE END OF THE SEASON NEGATIVE CONSEQUENCES ON ANIMAL HEALTH AND PRODUCTION			INCREASED RESTING TIME AND CONSEQUENTLY REDUCED GRASS CONSUMPTION; HIGHWATER REQUIREMENTS
ADAPTATION MEASURES	Adapt grazing tracks for watering the animals	Rational management of water points on pastures	Search for long-lasting supply solutions (impluviums, catchments, cisterns, drinkers, etc.)	Restore traditional irrigation systems and improve irrigation efficiency by sprinkling	Abandonment of a grazing area or early démontagnage	Increase the consumable coarse vegetation or shrubs grazing and supplementary feeding of lactating cows	• Improvement of grazing efficiency (rotational grazing) • Improvement of pasture quality: optimal manure management, elimination of undesirable species, 24 hours grazing time	Inclusion of trees and appropriate management of forest providing shaded areas in mid- and low-elevation pastures	Delaying the grazing of grasslands that dry out less quickly and lower areas, to preserve grass for the end of the season	Increased the coarse vegetation grazing at the end of the grazing season	Early démontagnage	Changing grazing times (earlier, later, night grazing)
MANAGEMENT ISSUES		• Water supply possibilities • Promoting the use of movable watering tanks	• Monitoring the quantity, quality and location of equipment • Promoting the use of movable watering tanks	• Costs (installation) • Promoting the use of movable watering tanks	Distance of the alpage from the farm	• Beware of too early climbing to higher pastures • Difficult to maintain the same milk production with this type of resource		**Predators:** alert for young and little livestock		Difficult to maintain the same milk production with this type of resource		
BIODIVERSITY CONSERVATION	Watching out for possible deterioration of vegetation and soil related to additional animal movements	**Vegetation and minor species:** direct impact from trampling and pathways	**Habitat:** direct impacts on wetland habitats served by freshwater springs and on the springs themselves **Fauna:** direct impacts on aquatic invertebrates and amphibians **Caution!** Creation of temporary habitats that may act as ecological traps	• Habitat changes, decrease species number due to increased soil moisture • Managing direct impact of mechanical means	Assessment depends on location and duration of abandonment	**Flora:** risk of over-selection by livestock	In case of the predator presence, 24 hours grazing time is feasible only with supplementary helpers (guardian dogs or herders)	**Grazing in the woods:** **Fauna:** direct disturbance on hazel dormouse, Chiroptera, black grouse, woodpeckers, owls **Beware of guardian dogs:** prey on chicks or young ungulates **Flora:** must be practice on graminoid herbaceous undergrowth	Beware of overgrazing of fragile grasslands		Positive effect	In case of predators presence only sunrise and sunset grazing are manageable (with supplementary helpers like herders and livestock guardian-dogs)
TECHNICAL ISSUES	Adaptation of grazing usually set on vegetation	Create a water distribution network on the alpage	Find the right compromise to avoid the multiplication of equipment	Complex and time-consuming work	A truck is needed to transfer the animals	Animal monitoring that will try to seek out the greenest grass at higher elevations	• Control of the herd by the shepherd • Labor intensive	Adapted forest thinning techniques		Mastery of tight guarding or fence-setting	Winter hay stocks utilisation	• Night grazing is impossible if predators are present • Shepherd waking up very early • Flexibility depends on production orientation and husbandry system
FACTORS FOR FAILURE OR SUCCESS	Early summer, assessment of a possible risk of water shortage	• Important investments • Shepherd skills (training)	• Financing of works and equipment • Accessibility	• Access of pastures to construction vehicles (mini excavators) • Funding of works	Flexibility and stocks on the farm	• Shepherd skills (training) • Water availability	Shepherd skills (training)	Integrated silvo-forestry management	Risk of not using some pastures at the end of the season		Flexibility and stocks on the farm	Presence of a shepherd's helper

CLIMATE RISKS	RAINY SUMMER	HEAVY RAINFALL	VERY MILD AUTUMN
CONSEQUENCES ON THE ENVIRONMENT (SOIL, VEGETATION AND WATER) OR ANIMALS	WET SOILS	IF VEGETATION IS SPARSE, INCREASED RUN-OFF AND SOIL LOSS	GOOD PASTURE CONDITIONS AT THE END OF THE GRAZING SEASON
POTENTIAL CONSEQUENCES FOR THE PASTORAL SYSTEM	DEVELOPMENT OF PAW DISEASES	DAMAGE TO PASTURES	POSSIBLE EXTENSION OF THE GRAZING PERIOD IF GRASS IS STILL PRESENT
ADAPTATION MEASURES	• Preparation of grazing animals (hooves cutting, footbaths). Care and isolation of sick animals • Prioritise areas where vegetation is sparse (or less tall)	Continuous and careful maintenance of the drainage channels and the road network (paths, tracks,...)	Late démontagnage
MANAGEMENT ISSUES	High risk of predation in bad weather		
BIODIVERSITY CONSERVATION	Possible transfer to wildlife	Managing the direct impacts of interventions with mechanical means	• **Flora:** overgrazing of fragile grasslands • Competition with animals preparing for migration (avifauna) e ungulates descending in altitude and marmots.
TECHNICAL ISSUES	Intensive work	Intensive work	
FACTORS FOR FAILURE OR SUCCESS	• Shepherd and farmer skills (training) • Availability of personnel • Necessary equipment set up	Manpower availability	Flexibility of farm organisation

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