Technical Sheet for Solution Implementation

Reducing Heat in Stables

Thematic Area: Environmental Sustainability.

Priority: Management of resources and adaptation of practices to climate changes.

Need: How to adapt your activities to extreme heat.

Solution EU Number: CC-5.

Content of the Solution: Reduce heat in the stables to improve health and welfare of equines and workers, avoid heat stress and reduce consumption of water.

Key Contacts:
- Agricultural chambers, advisors.
- In France : Climabat project

Case Study: Not available.

Reasons for Implementing this Solution

Excessive heat in stables can severely impact animal welfare, reduce productivity, and increase the risk of heat stress in equids. Implementing passive and structural strategies helps maintain a cooler environment, improving overall animal comfort and health during hot periods.

Description of Solution Strategies

To reduce heat inside stables, the following strategies should be considered:

1. Promote ventilation: air circulation in stables can be promoted with different type of ventilation: "natural ventilation" or Canadian well or artificial ventilation, here we will focus only on natural ventilation:

- Orient buildings toward prevailing winds to maximise cross-ventilation. Avoid placing adjacent buildings or natural obstacles that block airflow. Ventilation is most effective in narrow, wind-exposed and self-contained buildings as cross-flow air circulation is facilitated. The long sections must not be obstructed by adjacent constructions (silos, processing block, nursery, storage or natural obstacles (dense hedges, talus)). Therefore, when developing the farm site, extensions and outbuildings must be carefully considered so as not to penalize ventilation in the dairy cow house during winter and summer. When building new buildings, the location and exposure of the building to the most frequent winds is essential.

- Maximise open space in the lower wall areas, especially on the long sides of the building, to enhance air movement at the animals' level. To bring air speeds at the level of animals, the solution in natural ventilation is to arrange free openings

as low as possible in long-pan. Thus, the masonry heights should be reduced to the maximum.
- Integrate adjustable or removable cladding systems, such as articulated panels, sliding openwork cladding, adjustable slats, guillotines, or curtains, considering safety and practicality.

2. Limit Heat Radiation to the Building: To contain the increase in ambient temperature in a building, the radiation of the walls and roof must be limited and direct sunlight on living areas must be avoided. The following recommendations should be incorporated into the design or modification of new buildings:

- Reduce masonry height on sun-exposed walls (south, southwest, west) to prevent heat storage and improve air circulation at animal level. The walls store heat during the day and release it at night, which delays night-time cooling inside the livestock buildings. In addition, the walls prevent air circulation in the lower part of the animals.

- Avoid translucent roofing materials on sunny sides as they can locally raise perceived temperatures by up to 3°C. If needed, install them on north or east sides and compensate with facade openings. The reduction in light input via the roof can be compensated by the input of light through the cladding of the facades and gables of the building, while also limiting the radiation. In existing buildings, translucent sheet metal can be covered from the inside with shading paint used by greenhouses. However, to do this work and avoid the risk of accidents, it is necessary to comply with safety rules.

- Avoid dome-type roof lights that intensify the greenhouse effect. Prefer open ridge designs (e.g., flagstones with wind shields). The low-width (80 cm) dome is a solution only when the roof is totally opaque (insulated roof for example) and for buildings of large width.

- Insulate roofs, particularly in low-volume buildings where the roof is near the animals. Even a 4 cm insulation board can reduce the temperature felt by ~2°C. The choice to isolate can also be partial on the climbers exposed to the south. An insulation board thickness of 4cm is sufficient. For large buildings, the interest of insulation in hot periods is reduced. The roof stores heat, but the impact on temperature at the animal level is reduced. In this case, the main thing is to bring shade is to ensure a sweep within the building.

- Use light-coloured roofing materials (e.g., white) to reflect solar radiation and reduce heat absorption (albedo effect). Regarding this last recommendation, pay attention to local architectural constraints.

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Implementation Steps

1. Site Assessment
   - Identify sun exposure and prevailing wind directions.
   - Evaluate existing structural elements and airflow obstructions.

2. Building Modifications
   - Reduce or modify masonry height on sun-exposed walls.
   - Replace or cover translucent roof panels with shading paint (for existing buildings) or relocate them to less sunny sides in new constructions.
   - Insulate low roofs near animals with suitable insulation (e.g., 4 cm panels).

3. Ventilation Enhancements
   - Add or enlarge lower-wall openings to improve airflow at animal level.
   - Install appropriate opening mechanisms (e.g., curtains, panels, slats) tailored to building structure and safety needs.

4. Roof Design & Colour
   - Prefer open ridge systems over dome lights.
   - Use reflective light colours for roof surfaces.

5. Farm Layout Optimization
   - Plan extensions and new buildings to preserve wind exposure and ventilation pathways for existing structures.

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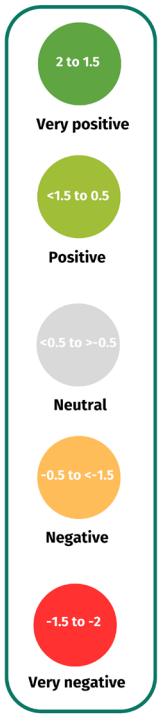
How Will this Solution Impact the Performance of your Farm ?

TOPIC	SCORE
Social	1.75
Economics	0.75
Welfare	1.25
Health	1.50
Environmental	1.17
Pasture access and management	0
Global	1.17



Color coding explanation

Socioeconomics: This solution will support the social performance of the farm because it improves overall working conditions for staff by reducing heat stress, enhances animal welfare by avoiding overheating and related diseases, and fosters a healthier environment in the stables. It also strengthens the farm's public image and outreach, as clients and visitors perceive the visible improvements in horse comfort and care positively. Additionally, reducing risks of heat-related dermatological and respiratory diseases contributes to better health outcomes for both horses and people in contact with them.

This solution will support the economic performance of the farm because it indirectly enhances productivity and operational efficiency by improving worker comfort and reducing heat-related incidents. It also helps lower potential veterinary and management costs by preventing diseases linked to excessive heat and humidity. While it does not generate immediate large increases in revenue or farm capital, the improvements in animal health, worker efficiency, and sustainability justify consistent moderate positive economic benefits over time.

Health & Welfare: This solution will enhance the overall health performance of the farm, as overheating is a major factor that can impair and disrupt several body systems in animals. Therefore, constructing appropriate facilities or adapting existing ones will reduce the impact of heat on livestock.

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Similarly, this measure will have a very positive effect on equine welfare, since overheated animals suffer from thermal stress and general discomfort. Farms with heat-resistant buildings will perform better compared to those lacking adequate protection from heat.

Environmental Sustainability: This solution supports the environmental performance of the farm. It is good for climate adaptation, providing energy-efficient, low-emission alternatives to combat rising temperatures. It promotes sustainable building practices that reduce the environmental footprint of equine farming. Key Strengths: Strong climate resilience Passive, non-electric systems. In addition, reduced heat-driven water consumption leads to better water management. Direct biodiversity and impacts are limited unless the solution is expanded into the landscape or integrated into broader farm design.

This solution does not have effect on the land access or management performance of the because it is about stable management.

So globally, this solution will support the performance of the farm.

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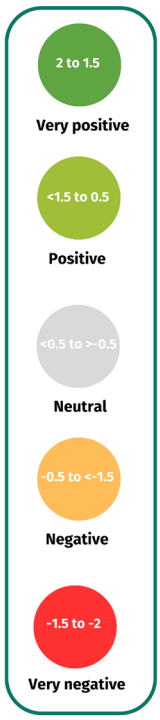
How Will this Solution Impact the Resilience of your Farm?

TOPIC	SCORE
Social	1.46
Economics	0.88
Welfare	1.08
Health	1.29
Environmental	0.81
Pasture access and management	0.33
Global	1.01



Socioeconomics: This solution will support the social performance of the farm facing external challenges assessed because it strengthens resilience, safeguards horse welfare, and ensures good working conditions for staff under diverse pressures. By maintaining welfare standards, safety, and comfort, it reinforces the farm's social responsibility, adaptability, and public trust. This solution will support the economic performance of the farm facing external challenges assessed because it reduces operational costs related to energy, water, veterinary care, and maintenance, helping protect profit margins.

Health & Welfare: When the farm faces external challenges, its health performance will be supported by this solution, as it reduces pain and (possibly) mortality caused by heat stress, pulmonary inefficiency or other health issues. As a result, the farm becomes more resilient to external pressures. Also, this solution will directly enhance the welfare performance of the farm when faced with external challenges. Increased heat resilience translates into an improved emotional state of the horses and better, comfortable living conditions.

Environmental Sustainability: This solution will support environmental performance of the farm facing external challenges assessed because climate-friendly infrastructure improves sustainability without relying on volatile energy markets and maintaining compliance with expected future environmental regulations. This solution will not impact land access or management performance of the farm facing external challenges assessed because it is not related to land access or management. So globally, this solution will support the resilience of the farm.

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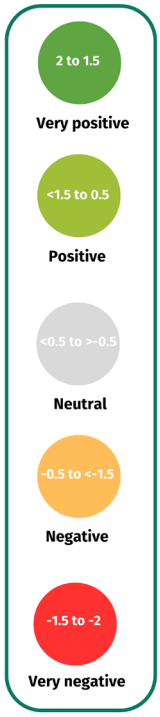
How Can this Solution Help your Farm Cope with Specific External Challenges to Become More Resilient?

CHALLENGES	SCORE
Inflation	1.13
Pandemic	0.92
High welfare standard	1.21
High infectious diseases	1.08
Extreme weather event	1.08
Loss/limited access to grassland	0.63



Inflation & Social Crises: This solution will support the global performance of the farm facing inflation because it reduces operational costs, protects profit margins, and ensures stable working and living conditions for both horses and staff. By improving sustainability, animal welfare, and staff retention while lowering reliance on volatile external resources, it strengthens overall resilience and long-term stability of the farm.

This solution will support the global performance of the farm facing pandemics because it reduces dependence on labor and energy, safeguards horse welfare under disrupted routines, and eases the workload and stress on limited staff. By minimizing health risks, maintaining stable conditions, and cutting operational costs, it strengthens the farm's resilience, adaptability, and capacity to recover after the crisis.

Welfare & Diseases: This solution will support the global performance of the farm when facing infectious disease challenges. Particularly, it contributes to reduced mortality rate caused by the disease and the reduction of curative medication as healthy and heat-protected animals are more resistant to infectious diseases. Good ventilation is also a key to limiting the spread of disease.

This solution strengthens the farm's global performance when adapting to compulsory high welfare standards. Relieving the animals from heat by ensuring a solid foundation on welfare-based comfortable building and shelters, this solution

helps the farm maintain strong performance by improving social outreach, profitability, good maintenance and positive emotional state as desired by enhanced welfare legislation.

Climate Change & Access to Land: This solution will support the global performance of the farm facing abnormally high temperatures and/or draught because during a dry season, with higher costs taking new building work can be consider too expensive, but any cooling system that reduces heat and increases ventilation would be beneficial. In this scenario, the solution is a critical asset for ensuring equine welfare, protecting farm viability, and maintaining compliance with expected future environmental regulations.

Land access/management challenge: this solution will support the global performance of the farm facing loss or limited access to agricultural land because a stable that reduces heat and increases ventilation is always cost effective. While the solution doesn't replace the ecological or nutritional role of pasture, it offers practical infrastructure-based resilience, allowing farms to maintain welfare standards and operations in increasingly constrained landscapes. This solution increases farm's ability to cope with loss or limited access to land in all other aspects than halting biodiversity loss or access to land.

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Cost-Benefit Analysis

Costs

Socioeconomics:

- Initial Investment: Costs for retrofitting (e.g., installing adjustable ventilation panels, insulation, reflective materials), or for new construction planning and cost of labor.
- Downtime/Disruption: Some farm activities may need to be rescheduled or paused during construction.
- Learning Curve: Staff may need training to understand how to adjust modular systems or ventilation features for seasonal use.
- Aesthetic/Planning Constraints: In areas with architectural restrictions, adapting stable colors or designs may create conflicts or extra costs.
- Costs could be higher if protected buildings have to be remodeled.
- Cost from advisory services (Ability of the farmer to utilize the results, there can be a need for advisory services).

Health & Welfare:

- Transitional Discomfort: During retrofitting or reconstruction, Equines may experience stress due to noise, temporary relocation, or disrupted routines.
- Safety Risks: Poorly planned or installed ventilation features (e.g., sharp edges, unsecured panels) can pose physical hazards.

Benefits

- A Improved Working Conditions: Cooler and more comfortable environments lead to better worker safety, reduced heat stress, and improved job satisfaction.
- Reduced Operational Costs: Passive ventilation reduces reliance on mechanical cooling systems, saving on electricity and maintenance.
- Lower Veterinary and Emergency Costs: Healthier equines require fewer emergency interventions related to heat stress.
- Enhanced Reputation & Marketability: Farms that prioritize welfare and sustainability can strengthen their brand, attract more clients, and build trust in local communities.
- Long-Term Asset Value: Infrastructure improvements can raise the long-term value of farm buildings and reduce depreciation.
- In general better animal conditions would give the equine farmer a better appreciation from outside lookers.

- Reduced Heat Stress: Equines maintain better core temperatures, leading to improved physical performance and lower risk of illness.
- Improved Respiratory Health: Better airflow reduces dust, ammonia buildup, and humidity-related respiratory issues.
- Lower Mortality and Injury Risk: Equines are less likely to experience fatigue, colic, or accidents caused by restlessness in overheated environments.

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Costs

- Adjustment Period: Equines sensitive to airflow or draft may need time to acclimate to increased ventilation or different stable conditions.
- These costs are typically short-term and manageable through careful planning and good construction standards.

Benefits

- Fewer Medications: With a healthier baseline, equines require fewer treatments or supplements to manage heat-related conditions.
- Better Behavior and Mental State: Comfortable equines are calmer, more sociable, and easier to handle, improving their overall welfare and reducing training issues. Equine farmers, workforce and equine welfare would benefit from reducing heat in the stables to improve health and welfare of equines and workers.

Environmental Sustainability :

- Material Use: Construction and retrofitting require resources (e.g., metal, insulation, plastic), which may have embodied carbon or waste impacts.
- Landscape Modification: In some cases, removing hedgerows or natural barriers to increase airflow could reduce biodiversity or shade.
- Transport Impact: Delivery of construction materials and machinery can result in minor emissions or fuel use.
- These costs are moderate and context-dependent, and can often be reduced through eco-conscious sourcing and smart design choices. Environmental costs would be higher at the begining with work being done, but environmental returns would be positive very quickly.

- Reduced Carbon Footprint: Passive solutions like natural ventilation and reflective materials reduce energy use, aligning with climate targets.
- Water Conservation: Less heat stress means equines consume water more efficiently, reducing overall water usage on the farm.
- Sustainable Building Practices: Encourages use of environmentally conscious designs (e.g., green materials, less mechanical intervention).
- Climate Adaptation: Enhances farm resilience during extreme weather, contributing to sustainable agricultural systems. An smart air stable would reduce water consumption.

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Costs

Cooperation between Farms:

- Perceived Inequity: Farms that invest in welfare-improving systems might expect higher recognition or returns, potentially causing tension if nearby farms don't follow.
- Shared Infrastructure Challenges: For farms sharing facilities (e.g., manure storage, feed silos), restructuring airflow and building orientation might create disagreements.
- These are mostly social and logistical costs, not financial, and can be mitigated through dialogue, joint planning, or community-led funding.

Benefits

- Knowledge Sharing: Early adopters can share best practices with other farms, increasing innovation and efficiency across the sector.
- Community Resilience: As more farms adapt, the local agricultural network becomes more resilient to climate extremes.
- Potential for Group Investments: Multiple farms in a region may jointly apply for grants or coordinate infrastructure improvements.
- Farmers sharing ideas and trying new products would benefit.

Additional Resources

Websites

- English
  - Ventilation in the stables (also available in French) https://equipedia.ifce.fr/en/equipedia-the-universe-of-the-horse-ifce/infrastructure-and-equipment/establishments-and-environment/buildings/ventilation-in-the-stables
  - Horsekeeping: Influence of Three different Ventilation Systems on Stable Climate https://www.agrarforschungschweiz.ch/en/2022/12/horsekeeping-influence-of-three-different-ventilation-systems-on-stable-climate/

- French
  - Privilégier la ventilation naturelle https://climatbat.chambres-agriculture.fr/bovins/anticiper-la-saison-chaude/des-ouvertures-modulables
  - Détention de chevaux: influence de trois différents systèmes de ventilation sur le climat d'écurie https://www.agrarforschungschweiz.ch/fr/2022/12/detention-de-chevaux-influence-de-trois-differents-systemes-de-ventilation-sur-le-climat-decurie/

- German
  - Pferdehaltung: Einfluss von drei verschiedenen Lüftungssystemen auf das Stallklima https://www.agrarforschungschweiz.ch/2022/12/pferdehaltung-einfluss-von-drei-verschiedenen-lueftungssystemen-auf-das-stallklima/

Publications

- French
  - Holzer S., Keller M., Humbert F.-L., Laube D., Burren A., Herholz C (2022): Influence de trois différents systèmes de ventilation sur le climat d'écurie. Recherche Agronomique Suisse, 13, 2022, 225-231 https://doi.org/10.34776/afs13-225
  - Jungen R., Bollhalder N., Kreis L., Humbert F.-L., Kocher J., Holzer S., Herholz C., Wyss C. (2024) Qualité de l'air dans l'écurie : Conseils pour préserver la santé des chevaux. Agroscope Transfer, 550, 2024. https://ira.agroscope.ch/fr-CH/Page/Einzelpublikation/Download?einzelpublikationId=61724

- German
  - Jungen, R., Bollhalder, N., Kreis L., Humbert, F.-L., Kocher J., Holzer, S., Herholz, C., Wyss, Chr. (2024): Das optimale Klima im Pferdestall. Tipps zur Förderung einer guten Luftqualität in Ställen und Gesunderhaltung von Pferden. Hrsg. Agroscope, Schweizer Nationalgestüt SNG https://ira.agroscope.ch/fr-CH/Page/Einzelpublikation/Download?einzelpublikationId=61725

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Annex

Ideas to Animate a Workshop About the Solution

- Ask a construction company, ventilation system provider, or agricultural advisor specialized in stable design or climate adaptation in animal husbandry to sponsor the workshop.
- Find a model equine farm that has implemented natural ventilation systems or passive cooling design.
- Demonstrate tasks such as adjusting ventilation panels, measuring air flow, or applying reflective roofing paint, and let participants try these hands-on.

Proposed Structure for the Workshop on Reducing Heat Through Natural Ventilation and Structural Measures in Equine Farms

1. IIntroduction to Heat Reduction Strategies in Equine Stables

- What are natural ventilation and passive building adaptations?
- Key features: orientation, roof/wall materials, insulation, airflow management.
- Types of solutions: open ridge systems, light-coloured roofs, adjustable facade openings, insulation boards, shading systems.

2. Benefits for Equine Farms

- Improved Animal Welfare: Reduction in heat stress, better behaviour.
- Health Benefits: Fewer respiratory/dermatological issues.
- Operational Gains: Less reliance on energy-intensive cooling, improved worker comfort and safety.
- Better Public Image and Potential Financial Incentives.

3. Practical Applications

- Openings adapted to horse height and airflow needs.
- Modular wall elements for natural airflow regulation.
- Options for both new buildings and retrofitting existing stables.

4. Choosing the Right Approach for Your Farm

- Assess sun/wind exposure and current stable layout.
- Compare roofing types, ventilation options, insulation materials.
- Consider usability, durability, cost, and regional building rules.

5. Hands-On Demonstration

- Live demo: adjusting facade panels, testing airflow with smoke or handheld anemometers.
- Participants try: opening/closing panels, inspecting insulation, using shade paint.
- Show before/after temperature measurements or infrared thermography.

6. Maintenance and Troubleshooting

- Cleaning and maintaining ventilation openings.
- Seasonal adjustments (e.g., winter closing).
- Monitoring airflow and temperature (basic tools, e.g., thermometers, humidity sensors).

7. Case Studies and Real-World Examples
- Farm X with ridge ventilation + white roofing.
- Farm Y retrofit with insulation and open lower walls.
- Operator testimonials: What worked, what didn't, tips and pitfalls.

8. Cost Analysis and ROI
- Compare costs of retrofitting vs. benefits (animal health, lower energy bills).
- ROI based on building type, horse number, local climate.
- Possible subsidies or regional funding for climate adaptation.

9. Q&A Session
- Discuss feasibility in historical buildings, protected sites, etc.
- Address local climate variations, safety questions, or design limitations.

10. Wrap-Up and Resources
- Key takeaways on passive heat reduction strategies.
- List of suppliers, tools for airflow calculation, and grant programs.
- If partnered: access to discounts, trial materials, or follow-up consultation.
-