Food and Agriculture Organization of the United Nations

STANDARDS ON GOOD AGRICULTURAL AND ENVIRONMENTAL CONDITIONS OF LAND

INTRODUCTORY HANDBOOK


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ABBREVIATIONS AND ACRONYMS

CAP ..... common agricultural policy (of the European Union)
FaST ..... farm sustainability tool for nutrients
ha ..... hectare (1 ha = 10 000 square meters)
GAEC..... good agricultural and environmental conditions
IACS ..... integrated administration and control system
IT..... information technology
LPIS ..... land parcel identification system
SMR ..... statutory management requirements
UAA ..... utilized agricultural area

WHAT ARE STANDARDS ON GOOD AGRICULTURAL AND ENVIRONMENTAL CONDITIONS OF LAND (GAEC)?

European Union farmers must respect cross-compliance

The European Union Common Agricultural Policy, accounting for 37 percent of total European Union expenditure, supports European Union farmers through a range of payment schemes. In return, farmers must respect a set of European Union rules on environmental protection, animal and plant health, and food safety. The interplay between this respect for rules and the support provided to farmers is called cross-compliance.

... including its environmental requirements

Cross-compliance is an important tool for integrating environmental requirements into the Common Agricultural Policy. It ensures that support granted to farmers contributes to promoting sustainable agriculture and the environmental objectives of the European Union. In other words, environmental cross-compliance requirements make sure that public money is paid for farming that serves public policy objectives and promotes the provision of environmentally related public goods and services. Environmental cross-compliance is made up of:

1. Statutory management requirements, which are a selected number of obligations incorporated in the scope of cross-compliance rules from existing European Union environmental directives and regulations. Statutory management requirements are agricultural management standards (provisions) drawn from the application of relevant articles of these directives and regulations.

2. Standards on good agricultural and environmental conditions of land, abbreviated as "GAEC." This publication focuses solely on GAEC.

GAEC standards

In order to ensure that all agricultural land, including land no longer used for production purposes, is maintained in good agricultural and environmental conditions, farmers are obliged to maintain their land according to a set of good agricultural and environmental conditions standards. These standards call for the implementation of farming measures aimed at the mitigation of and adaptation to climate change; the maintenance of permanent grassland; the protection of the soil against erosion; the maintenance of soil fertility through care for soil organic matter and soil structure; the protection of water against pollution by plant nutrients and pesticides; the protection of biodiversity; and the retention of landscape features.

Currently under discussion in the European Union

The European Union is in the process of redefining the Common Agricultural Policy architecture and its mechanisms for the new programming period 2021–2027. The final text for the GAEC standards is still under discussion. At present, there is a dynamic, complex and lengthy process of discussions and negotiations ongoing among the parties involved in the decision. These include the European Commission, the Council of the European Union, the Court of Auditors, the Economic and Social Committee, and the European Committee of the Regions. More than a hundred opinions and discussion documents have been in circulation and are being considered.

Member States are responsible for administrating GAECs

The GAEC standards are not "recommendations" but a set of compulsory requirements that each European Union Member State must adhere to. However, the European Union-level good agricultural and environmental conditions rules set just the essence of each GAEC standard, in few words – without a list of options, exemptions, etc. The exact good agricultural and environmental conditions requirements that farmers must meet must be set by Member States, not at the European Union level. Member States are the main administrators of GAEC implementation. They must establish a definition and requirements of each GAEC for their agricultural circumstances, taking into account the specific characteristics of the areas concerned. These include soil and climatic conditions, existing farming systems, land use, crop rotation, farming practices and farm structures. Additionally, Member States also must set up management, inspection and sanctions systems for GAEC . Member States may implement a given standard differently for different regions, according to soil, climate, land use, farming structures, etc. Member States also may lay down additional, stricter standards to meet European Union objectives, but they are not permitted to water down the minimum GAEC requirements defined by the European Commission. Serbia has been setting up its own GAEC standards and rules, too. It is hoped that this handbook will help along the way.

Inspection of the implementation of GAEC standards

GAEC inspections involve verification that farmers are complying with the prescribed standards. In principle, 1 percent of all beneficiaries of the Common Agricultural Policy payments are selected for full cross-compliance inspections, including of the implementation of GAEC. Holdings are selected for inspection using risk analysis. Approximately 20–25 percent of holdings are selected at random, with the remainder selected using risk criteria (e.g. previous penalty cases, late notifications of important farming practice changes, etc.). Inspections are done off-farm, "in the office" (administrative "paper checks") and as on-the-spot checks. The inspection is carried out by the paying agency, sometimes in association with other inspectorates and/or authorities with primary responsibility for certain environmental requirements (e.g. water protection, nature protection, etc.).

GAEC main issues, requirements and standards	
Main issues	**Requirements and standards**
Climate change (mitigation of and adaptation to)	**1.** Maintenance of permanent grassland based on the ratio of permanent grassland in relation to agricultural area at national, regional, subregional, group-of-holding or subholding level. The variation of this ratio is to be maximum 5 percent compared to the reference year (2015 or 2018)
	2. Minimum protection of wetland and peatland at latest by 2024
	3. Ban of burning arable stubble, except for plant health reasons
Water Protection	**4.** Establishment of buffer strips along water courses
	5. Use of Farm Sustainability Tool for Nutrients[1]
Soil (protection and quality)	**5.** Tillage management or other appropriate techniques to limit the risk of soil degradation, taking into account the land gradient
	6. Minimum soil cover in period(s) and areas that are most sensitive
	7. Crop rotation or other practices aimed at preserving the soil potential, such as crop diversification
Biodiversity and landscape (protection and quality)	**8.** • In areas that are most appropriate, minimum share of agricultural area devoted to: I. Non-productive features or II. Catch crops or nitrogen-fixing crops, cultivated without plant protection products • Retention of landscape features • Ban on cutting hedges and trees during the bird breeding and rearing season As an option, measures to avoid invasive plant species
	9. Ban on converting or ploughing of permanent grassland in Natura 2000 sites

[1] In June 2018, the European Commission proposed 10 GAEC, but in December 2018, the Council of the European Union proposed to remove GAEC 5 on the use of Farm Sustainability Tool for Nutrients (FaST). This tool was supposed to provide farmers useful recommendations/alerts concerning the application of nutrients on their parcels, thus helping to reduce nutrient leakage and greenhouse emissions while contributing positively to soil quality. In the meantime, several other influential stakeholders and Member States have supported the Council's proposal. As this position prevails today, it is unlikely that the Farm Sustainability Tool for Nutrients will be included in the list of GAEC. It has therefore not been elaborated on in this publication.


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GOOD AGRICULTURAL AND ENVIRONMENTAL CONDITION 1: MAINTENANCE OF PERMANENT GRASSLAND

Main objective and rationale

GAEC 1 ensures that permanent grassland (pastures and meadows) continues sequestering carbon and that the carbon stored in grassland soil remains there. It safeguards all permanent grassland against conversion to other agricultural uses (arable land, orchards, vineyards, etc.), as this would release into the atmosphere the carbon preserved in the grassland soil. This is of paramount importance because the concentration of carbon dioxide in the atmosphere has dramatically increased over the last century, causing the warming of the Earth's surface. Farmers can help to slow down and even reverse this process. By growing crops, they convert the excessive carbon in the atmosphere to green vegetation, as carbon accounts for 45–50 percent of the dry mass of crops. Carbon stored in below-ground vegetation and carbon returned to the soil by above-ground crop residues build up the soil organic matter, decreasing carbon concentration in the atmosphere. Globally, soil organic matter contains about twice as much carbon as there is in the atmosphere. Permanent grasslands are of vital importance in this respect. They store approximately one-third of the global terrestrial stock of carbon, most of which is accumulated in the soil.

Relevance for Serbia

This GAEC is highly relevant for Serbia. Permanent grassland is the single most dominant use of agricultural land in Serbia and is the country's most important reservoir of soil carbon. However, the area under permanent grassland in Serbia has been in decline. The latest official data from the Serbian Environmental Protection Agency indicate that the area under meadows shrunk by 15 percent in just four years (2014–2017), from 380 000 ha to 320 000 ha. On the other hand, climate change and greater climate variability are taking their toll in Serbia, too. In the past two decades, Serbia has been exposed to more frequent natural disasters, lower precipitation and higher air temperatures compared with the second half of the twentieth century. This trend is likely to continue, bringing more losses to Serbian agriculture and the well-being of its citizens.

What must the Government do?

GAEC 1 requires that the Government ensure the maintenance of permanent grassland based on a ratio of permanent grassland in relation to agricultural area (at national, regional, subregional, group-of-holdings or holding levels). The variation of this ratio is to be maximum 5 percent compared to the reference year (2015 or 2018). In other words, the Government just has to make sure that the area under permanent grassland remains constant and is not reduced by more than 5 percent in comparison to 2015 or 2018 (governments can freely choose which reference year suits them better). Requirements similar to those in GAEC 1 are not new to the Serbian authorities (or farmers). Article 18 of the Law on Agricultural Land from 2018 already prohibits temporary or permanent ploughing of meadows and pastures.

What must farmers do?

Serbian farmers can quite easily comply with this GAEC. It does not impose any specific management prescriptions on them – such as a grazing plan, rotational grazing, legume maintenance, fertilization regime, stocking rate or reseeding – or other practices that improve pasture fertility and are likely to enhance carbon sequestration. Farmers must simply maintain permanent grassland based on a ratio of permanent grassland in relation to agricultural area. The reduction of this ratio must be maximum 5 percent compared to a reference year to be set by the Government (2015 or 2018).

What must farmers not do?

Farmers are not allowed to expand the area under arable or permanent crops by reducing the area under permanent grassland. They must not alter the ratio of permanent grassland in relation to agricultural area at the expense of permanent grassland. However, GAEC 1 does not prohibit farmers from ploughing permanent grassland if an equally large area is converted into permanent grassland. The net soil carbon storage effect will be approximately the same – at least in the long run, because it will take time before the newly established grassland reaches the carbon sequestration level of the old permanent grassland.

Monitoring & inspection

The ratio of permanent grassland in relation to agricultural area can be easily monitored at farm, regional and national level through the data available in the Land Parcel Identification System (LPIS), an information technology system based on aerial ortho photos or satellite ortho imagery of agricultural parcels used to check payments made under the Common Agricultural Policy. If needed, this administrative monitoring can be complemented by visual inspections, including the taking of measurements or photos during on-the-spot checks.

Permanent grassland stores more carbon in the soil than do arable or permanent crops.

2014

2017

In just four years (2014–2017), Serbia lost one out of seven hectares of meadows.

GOOD AGRICULTURAL AND ENVIRONMENTAL CONDITION 2: MINIMUM PROTECTION OF WETLAND AND PEATLAND

Main objective and rationale

The main objective of this GAEC is to prevent the loss of carbon from carbon-rich soils – wetland and peatland – into the atmosphere. Wetland is land that is covered mostly by water, with occasional marshy and soggy areas. Peatland is land with peat soil, such as an active or former bog, and is mainly used as grassland. Both wetlands and peatlands are important stores of carbon – which, if released into the atmosphere, fuels climate change. Damaged wetlands and peatlands are a major source of greenhouse gas emissions, annually releasing almost 6 percent of global anthropogenic greenhouse gas emissions. It is therefore of the utmost importance to properly protect these soils and prevent their degradation by practices that accelerate carbon emissions, such as drainage, ploughing, peat excavation and others. Peatlands in good condition actively form peat, removing carbon dioxide from the atmosphere and storing carbon in the soil. Conversely, degraded peatlands may emit more carbon dioxide than they remove and may become a net source of greenhouse gases.

Relevance for Serbia

Serbia is quite rich in wetlands and peatlands, and these can be found at about 160 sites. Peatland covers about 70 000 ha, and wetlands cover about 70 000 ha more, of which 64 000 ha is designated as Ramsar sites – wetlands of international importance. A substantial proportion of these areas – including the well-known Labudovo Okno, Obedska Bara, Peštersko Polje, Carska Bara, Zasavica and Vlasina areas – are used for agriculture, mainly for traditional livestock rearing. Many Serbian wetlands and peatlands have been drained, notably, by river regulation works and drainage systems. This process has been slowed down, but recent estimates suggest that even today, about 50 ha of wetlands are being converted to agricultural land each year.

What must the Government do?

This GAEC requires governments to prescribe, by 2024, a set of appropriate (minimum) protection measures preventing carbon loss from wetlands and peatlands. As this is a new GAEC, at present there are no more detailed instructions about what "appropriate/minimum" protection measures should comprise and whether this requirement will also include restoration of already drained peatlands by re-wetting, notably those outside Natura 2000 areas.

What must farmers do?

The exact requirements of this GAEC to be followed by farmers will depend on what the Government defines and prescribes as appropriate and minimum practices for the protection of wetlands and peatlands. Farmers might also be required to maintain high water levels on wetlands and peatlands, as climate change resulting in reduced precipitation has lowered their groundwater table, accelerating their degradation. If peatlands have to be re-wetted, farmers farming on such land are likely to orient themselves to harvesting sedges for energy production, harvesting reeds for thatch, planting cattail for insulation material, grazing with water buffaloes, etc.

What must farmers not do?

The agricultural practices that will be prohibited on peatland and wetland still need to be defined by the Government. However, it is highly likely that operations bringing more oxygen into the soil and leading to microbial decomposition of the peat and thereby emission of substantial amounts of carbon dioxide and nitrous oxide will not be allowed. These include lowering the water table, draining peatland and burning or extracting peat.

Monitoring & inspection

Land Parcel Identification System aerial ortho photos or satellite ortho imagery (including hydrological features) of peatland and wetland can be used to check whether those areas have been managed according to the GAEC 2 prescriptions. If needed, this administrative monitoring can be complemented by on-the-spot checks.

With a surface area of 500 ha, Obedska Bara is the largest peatland area in Serbia. Much of this land is used for agriculture.

Most of the 200 ha peatland area in Peštersko Polje is used for agriculture.

GAEC 2 is likely to prohibit peatland drainage and peat extraction.

GOOD AGRICULTURAL AND ENVIRONMENTAL CONDITION 3: BAN ON BURNING ARABLE STUBBLE

Main objective and rationale

This is a dual-objective GAEC. It aims at contributing to halting climate change by preventing greenhouse gas emissions arising from burning arable stubble. But its second objective is the preservation of soil organic matter in agricultural soils because of mitigation of and adaptation to climate change.

Relevance for Serbia

This GAEC is highly relevant for Serbia not only because of the climate change problems it faces, but also because arable stubble burning is quite a widespread practice among farmers. In addition to reducing greenhouse gas emissions from agriculture, this GAEC also will help in conserving the soil organic matter content in Serbian agricultural soils, which is relatively low and has been in decline.

What must the Government do?

GAEC 3 requires governments to prescribe a ban on burning arable stubble and to control its enforcement. Such a regulation already exists in Serbia. The Serbian Law on Agricultural Land from 2018 and local administrations prescribe measures for protection against the burning of crop residues on agricultural land. However, these are neither being respected nor properly enforced.

What must farmers do?

This GAEC requires farmers to refrain from burning arable stubble. Arable stubble should instead be used as feedstuff or bedding material or incorporated into the soil, as this helps build up soil organic matter. In some countries, this GAEC does not apply only to cereal straw/cereal stubble but to arable crop residues (e.g. oilseed rape, maize, peas, soya and field beans harvested dry, etc.). In addition, some countries also ban the burning of green vegetation, such as heather, rough grass, bracken, gorse, vaccinium, etc.

What must farmers not do?

Farmers are prohibited from burning arable stubble. Burning arable stubble is allowed only in exceptional cases, for plant health reasons – to prevent the spread of or to suppress plant pests and diseases, for which an official administrative measure must exist. In such a case, burning must be done at the right time of day, and under favourable weather and fuel conditions, to ensure that the fire's intensity, rate of spread and extent of spread are fully under control.

Monitoring & inspection

Aerial ortho photos or satellite ortho imagery can be used to check whether arable stubble has been burned. In most cases, this will be complemented by on-the-spot monitoring, which will check for evidence of the burning of arable stubble.


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As does existing Serbian legislation, GAEC 3 prohibits the burning of arable stubble.

GOOD AGRICULTURAL AND ENVIRONMENTAL CONDITION 4: ESTABLISHMENT OF BUFFER STRIPS ALONG WATERCOURSES

Main objective and rationale

The objective of this GAEC is to protect surface water from pollution by nutrients (nitrogen and phosphorous) and pesticides by creating buffer strips along watercourses. Excessive concentration of these substances in surface water can negatively impact the health and diversity of fresh and marine waters, including the plants and animals that live in those environments, as well as the health of humans and livestock drinking polluted water.

Relevance for Serbia

Official data indicate that Serbian water resources are of good quality. However, the present water quality monitoring programme is not robust enough, with inadequate density of water monitoring sites and inadequate spatial distribution and sampling frequency. Thus, the conclusions arising from the current programme might be inaccurate. In addition, there are no reliable data about the extent to which agriculture is responsible for existing water pollution. In agriculture-intensive regions, this is likely to be substantial. In Vojvodina, for instance, the water exceeds the prescribed concentration levels for nitrates and ammonium at nearly half of the water sampling stations. Because of all this, GAEC 4 is highly relevant for Serbia.

What must the Government do?

The Government must define a set of farming practices and guidelines for the establishment of buffer strips along watercourses and ensure that these are enforced. The current Serbian legislation prohibits the deterioration of water by the direct discharge of pollutants and hazardous substances, but it does not require farmers to implement measures to limit indirect water pollution, such as by establishing buffer strips along watercourses.

What must farmers do?

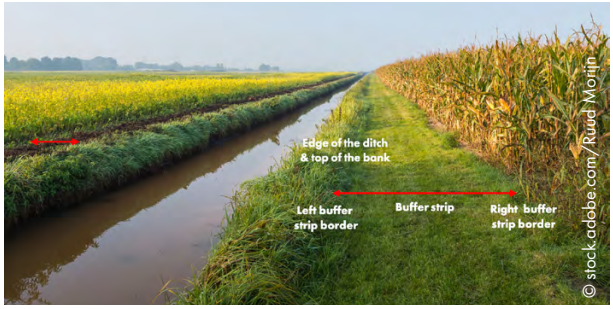
GAEC 4 requires that farmers maintain a green cover on strips of a prescribed width to be established alongside watercourses and that they restrict soil cultivation, storage and the application of manure, fertilizers and pesticides alongside watercourses. "Watercourses" are all surface waters, including coastal waters, estuaries, lakes, ponds, rivers, streams, canals and field ditches/drainage channels (including temporarily dry drainage channels). The buffer strips are established from the top of the bank of a watercourse to usually 2–10 metres away (for flowing water, such as rivers, streams, ditches, etc.) or 10–20 metres away (for still watercourses, such as ponds and lakes) on the landward side. Some countries also require that farmers produce and keep a map of their holding, showing all watercourses, springs, wells, boreholes and land within 10–50 metres of them (depending on the type of watercourse).

What must farmers not do?

Farmers must not cultivate soil, store and/or apply manufactured Farmers must not cultivate soil, store and/or apply manufactured nitrogen fertilizer, organic manure or pesticides to land that is situated (most commonly) within 2–10 metres of flowing watercourses and 10–20 metres of still watercourses. Some countries also forbid the application of manufactured nitrogen fertilizers to land with slopes greater than 12 degrees or to land that is waterlogged, flooded, frozen or covered in snow, as this is considered to pose a significant risk of nitrogen entering the watercourses. In some countries, livestock is not allowed to have access to watercourses; instead, water should be provided in drinking troughs wherever possible.

Monitoring & inspection

Whether a farmer complies with the buffer strip requirement is checked during on-farm inspections made by the competent authority (usually the paying agency). The width of the buffer strip is measured using GPS devices or a tape measure. Discoloured or burned-looking vegetation indicates the potential use of herbicides, while the absence of pests and diseases accompanied by unpleasant, non-natural odours indicates the likely use of pesticides. The buffer strip area is also checked for signs of supplementary feeding, traces of fertilizers (e.g. mineral fertilizer granules remaining on the soil) and/or livestock manure (e.g. slurry marks or solid manure deposits). In case of suspicion, the inspector can take plant and/or soil samples for laboratory testing.



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GAEC 4 requires the establishment of buffer strips along watercourses to prevent water pollution by pesticides and nutrients.

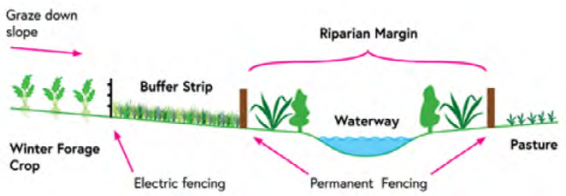


Figure 1. An advanced buffer strip design: permanent and electric fences along the buffer strip protect a watercourse adjacent to grazing land from stock damage and run-off.

Figure 1: ©Winter Management Good Management Practice (GMP, p. 7). 2020. https://www.amuriirrigation.co.nz/wp-content/uploads/2020/07/AIC-Winter-Management-Handbook.pdf

GOOD AGRICULTURAL AND ENVIRONMENTAL CONDITION 5: TILLAGE MANAGEMENT OR OTHER APPROPRIATE TECHNIQUES TO LIMIT THE RISK OF SOIL DEGRADATION

Heavy soil erosion by water.

Main objective and rationale

The main objective of this GAEC is to avoid and limit soil degradation, notably soil erosion. Eroded soils contain less organic matter, leading to decreased water holding capacity and increased run-off, resulting in reduced yields and increased water pollution. In addition to productivity losses and pollution, soil erosion causes damage to field structures, blockage of roads and ditches, damage to property and traffic accidents, and it increases the risk of flooding.

Relevance for Serbia

This GAEC is particularly important for Serbia. The country's topography (hills and mountains with steep slopes), climatic conditions (high annual precipitation and strong winds), vegetation cover and current agricultural practices make Serbian soils very prone to erosion and compaction. The latest official data from the Serbian Environmental Protection Agency suggest that as much as 53 percent of the area under extensive agriculture has a high or very high risk of soil erosion, while another 30 percent has a moderate risk of soil erosion. Conservation tillage is getting more attention but is still not being widely practised, notably in row crops such as maize, sunflowers and soybeans.

What must the Government do?

The Government must define and prescribe a set of tillage management and other techniques to limit the risk of soil degradation – and ensure its enforcement. The Serbian Law on Agricultural Land from 2018 already contains several key GAEC 5 elements. It prescribes a range of compulsory anti-erosive measures. On slopes with gradients greater than 10 percent, soil cultivation must be carried out perpendicular to the slope, and at least one-third of the area has to be covered by permanent vegetation. Agricultural land with a gradient of more than 25 percent should not be used as arable land.

What must farmers do?

Soil must be tilled in a way that limits the risk of soil erosion and the soil compaction that accelerates it, considering site-specific conditions, notably the slope gradient. On agricultural land with a high gradient (e.g. of 10 percent or more), ploughing may be carried out only perpendicular to the slope. In areas with an incline greater than prescribed by this GAEC, plant cover should be ensured during periods of rainfall until the preparation of the soil for the next seeding, depending on the crop. In areas prone to wind erosion, steps must be taken to reduce the risk of soil loss in spring by maintaining crop cover, using coarse seedbeds, shelter belts, etc.

The usage of appropriate machinery (and tyres) and going over the soil at the proper time should prevent/reduce soil compaction. Compaction on headlands and in tramlines caused by repeated vehicle movements should be avoided. Deep soil compaction should be corrected by carrying out subsoiling and/or by growing crops with strong, well-developed roots. Livestock farmers are required to

avoid overgrazing, heavy trampling or heavy poaching by livestock, notably at watering points and feeding areas. Overstocking must be avoided in autumn and winter when vegetation growth is slow or has ceased. It is recommended to inspect soils routinely for loss of structure and signs of damage, capping and erosion.

What must farmers not do?

Farmers must not do the opposite of what they are required to do (listed above). Records from European Union Member States suggest that the requirements set by this GAEC are among the most breached of all GAEC. The most common breaches relate to the ban on undertaking mechanical field operations and the use of heavy vehicles, trailers and machinery vehicles (notably those without low-ground-pressure tyres or dual wheels) on saturated and waterlogged soils to avoid soil compaction.

Monitoring & inspection

On-farm inspection can easily detect evidence of activities leading to soil erosion. Signs of water erosion include the following: channels (rills and gullies) in the soil; soil wash or sheet erosion, where soil is washed but no channels are formed (often seen as muddy run-off); deposits of eroded soil in valley bottoms, adjacent land, roads or watercourses; and localized flooding and pollution of watercourses with silt or muddy water. Signs of wind erosion are soil blown over crops, adjacent land, roads, watercourses, semi-natural habitats and/or property. Inappropriate tillage practices (e.g. ploughing up the slope), soil compaction and poaching damage caused by livestock or vehicle and machinery activity on waterlogged soil can be detected visually relatively easily, too.

To prevent soil erosion,GAEC 5 prohibits ploughing along the slope.

Contour tillage, or tilling sloped land along lines of consistent elevation, reduces soil erosion and conserves rainwater.

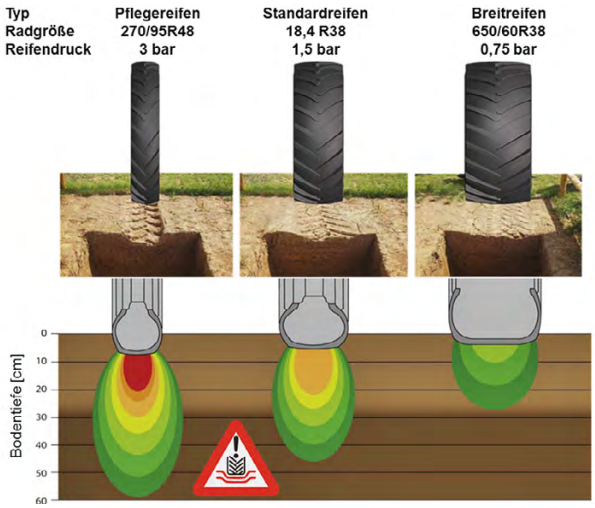


Figure 2. The use of low-ground-pressure tyres reduces soil compaction.

Radishes are a cover crop that alleviate soil compaction and that break the soil hardpan.

Figure 2: ©DLG-Merkblatt 356, Reifen, verändertt [2009, p. 31]. [Cited 13 November 2020].
https://www.dlg.org/fileadmin/downloads/landwirtschaft/themen/publikationen/merkblaetter/dlg-merkblatt_356.pdf

GOOD AGRICULTURAL AND ENVIRONMENTAL CONDITION 6: MINIMUM SOIL COVER IN PERIOD(S) AND AREAS THAT ARE MOST SENSITIVE

Main objective and rationale

The primary objective of GAEC 6 is to minimize soil erosion (by both wind and water) by requiring minimum soil cover in periods and areas that are most susceptible to soil erosion. Cover crops have dense stand that physically slows down the velocity of rainfall before it contacts the soil surface, preventing soil splashing and erosive surface run-off. Additionally, most cover crops have strong and well-developed root networks that help anchor the soil in place and increase soil porosity. Besides protecting soil from erosion, cover crops also help in improving soil structure and in reducing soil compaction, nitrogen run-off into surface water, and leaching into groundwater.

Relevance for Serbia

The use of soil cover, notably in the non-vegetation period, is not a widely adopted practice in Serbia. Cover crops occupy less than 1 percent of the utilized agricultural area, which contributes to and accelerates the problems related to soil erosion in Serbia described under GAEC 5. Cover crops are a particularly effective measure against wind erosion, which is a problem in the flatter, drier areas of Serbia, especially on sandy and peaty soils.

What must the Government do?

The Government must define the most critical periods (e.g. after harvest, during winter, etc.) and areas that are most sensitive to soil erosion (e.g. sandy soils or peatland prone to erosion by wind, soils with shallow profiles, soils in areas with very high or very low precipitation, etc.), and it also must ensure the enforcement of what has been prescribed in this respect. The Serbian Law on Agricultural Land from 2018 already contains several key GAEC 6 elements. It prescribes a range of compulsory anti-erosive measures but does not envisage minimum soil cover.

What must farmers do?

This GAEC requires that farmers protect the soil by providing minimum soil cover in the most sensitive periods and areas. Farmers are obliged to take all reasonable steps to protect soil by having a minimum soil cover. They have to ensure that soil is covered by vegetation – crop cover (a green/catch crop, non-food/non-feed crop, forage legumes, etc.), crop residue or stubble cover – or else ploughed. Livestock farmers are required to avoid overgrazing and poaching, as soil compaction may exacerbate soil erosion by wind.

What must farmers not do?

Soil in periods and areas defined as sensitive to soil erosion must not be left bare, without soil cover such as crops, stubbles, residues or other vegetation. Finely tilled bare (unsown) seedbeds are not permitted over the winter and must only be created close to sowing.

Monitoring & inspection

The implementation of this GAEC is assessed mainly during on-farm inspections carried out by the competent authority (usually the paying agency). The inspectors will check whether there is evidence of land with inadequate soil/ground cover within 3 to 4 months of ploughing, as well as whether there are fields with finely tilled soils that are not in the process of crop establishment.

Covering soil with maize residues after harvest (top) and by sowing cereal rye (bottom).

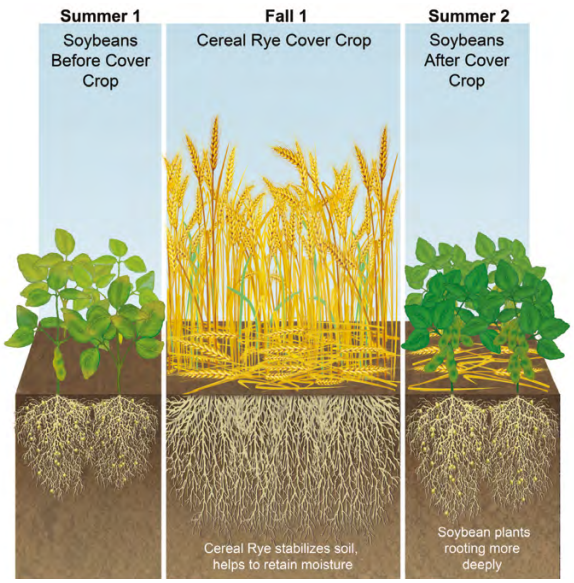


Figure 3. Cereal rye is an excellent cover crop that can be used in areas with intensive soya bean production.

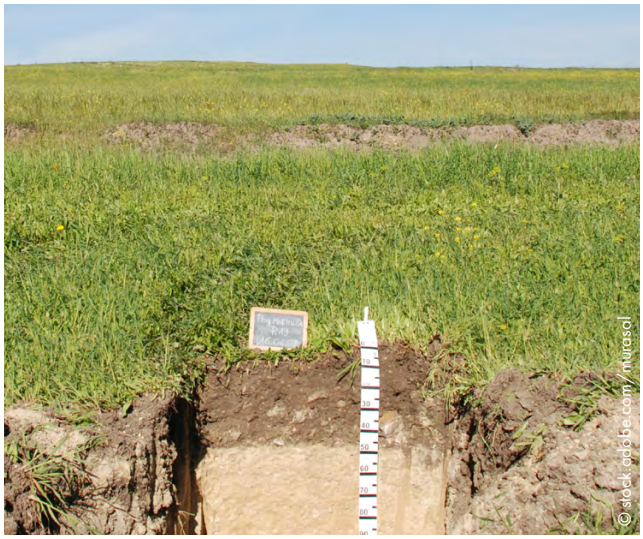
Figure 3: ©Carlyn Iverson. When Soil Moisture is at a Deficit or Irrigation is Needed - SARE [online]. [Cited 13 November 2020]. https://www.sare.org/publications/cover-crop-economics/an-in-depth-look-at-management-situations-where-cover-crops-pay-off-faster/when-soil-moisture-is-at-a-deficit-or-irrigation-is-needed/

Cover crops growing between rows of winter wheat stubble.

Oil radish (left) and black oats (right) are excellent cover crops.

Cover crops are excellent soil fertility builders, and many are a valuable source of fodder in wintertime.

Cover crops in a cabbage field.



Cover crops enhance soil fertility and attract farmers' attention.

Cover crops in vineyards.

GOOD AGRICULTURAL AND ENVIRONMENTAL CONDITION 7: CROP ROTATION OR OTHER PRACTICES AIMED AT PRESERVING THE SOIL POTENTIAL

Main objective and rationale

This GAEC seeks to preserve and improve soil fertility by enhancing crop diversification. Crop diversification is the growing of several different crops. It builds soil fertility by enhancing the formation of soil organic matter (notably by including grass–legume mixtures), by improving soil structure and by reducing soil erosion. It also protects water from pollution by pesticides and plant nutrients and reduces the negative effects of climate change. Finally, wider crop diversification also promotes biodiversity and helps control pests, diseases and weeds.

Relevance for Serbia

This GAEC is highly relevant for Serbia because the country's current crop rotation is very narrow, resulting in a decline of soil fertility and increasing difficulty in controlling pests, disease and weeds. Data from the Statistical Office of the Republic of Serbia show that cereals occupy 66 percent of all arable land in Serbia. Grain maize and fodder maize alone account for 40 percent of the total arable land. Just two crops – maize and wheat – make up 61 percent of the total arable area.

What must the Government do?

The Government must define minimum crop rotation patterns and make sure that these are enforced. Serbian legislation (the Law on Agricultural Land from 2018) already requires "introduction of crop rotation" (Article 18) but does not define any rules related to it. In addition, Article 62 requires that all managers of state-owned agricultural land "set up crop rotation" and keep records on crop production, which is subject to monitoring by agricultural inspectors. Moreover, Article 85 says that companies and other legal entities (but not private farmers!) can be fined from RSD 100 000 to RSD 1 000 000 if they fail to establish crop rotation. GAEC 7 is a new GAEC, and its detailed requirements are still unknown. But, besides crop rotation, this GAEC is likely to require the Government to also prescribe additional practices preserving soil potential, such as various forms of conservation tillage (reduced tillage, mulch till, no-till, etc.).

What must farmers do?

This GAEC requires that farmers practice wider crop rotation to preserve soil fertility. This is a new GAEC, and its detailed requirements are still unknown. However, it will most likely require that farmers implement at least a three- or four-year crop rotation. This implies rotation of small cereal crops, row crops, industrial plants, grass, clover or mixtures thereof. It also could require, for example, that the main crop does not occupy more than 70 percent of the arable land and that no two crops occupy more than 90 percent of the arable land – and that these two crops are not of the same family. This GAEC might also have different rules applying to different farm sizes. If GAEC 7 requirements are also extended to conservation tillage, farmers will have to practice this accordingly, too.

What must farmers not do?

Farmers will not be allowed to practice narrow crop rotation comprising an insufficient number of crops. The main crop, or two crops, will not be allowed to occupy more area than specified. Crops from no fewer than three distinct families will have to be used to design the rotation. It is also likely that it will be forbidden to grow the same crops in the same field (the same field of crop rotation) more than two years consecutively.

Monitoring & inspection

Whether a holding practices proper crop rotation can be easily monitored through the data available in the Land Parcel Identification System, based on aerial ortho photos or satellite ortho imagery of agricultural parcels. If needed, this administrative monitoring can be complemented by visual inspections during on-the-spot checks.

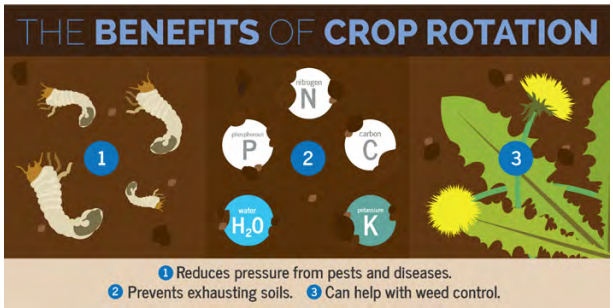
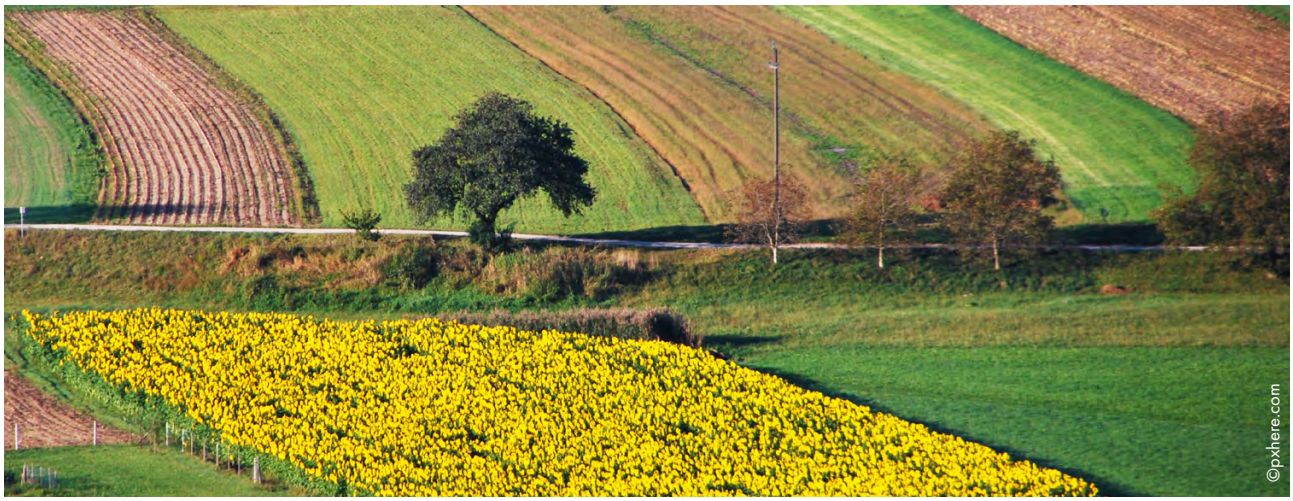


Figure 4. Crop rotation provides a range of agronomic, environmental and economic benefits.

Maize and wheat alone occupy 61 percent of Serbian arable land.

Figure 4: ©Fix.com. Easy Crop Rotation For Your Garden [online]. 2015. [Cited 13 November 2020]. https://www.fix.com/blog/three-year-garden-crop-rotation-plan/



Examples of diverse crop rotation in Serbia.

GOOD AGRICULTURAL AND ENVIRONMENTAL CONDITION 8: MAINTENANCE OF NON-PRODUCTIVE FEATURES AND AREA CONTRIBUTING TO THE IMPROVEMENT OF ON-FARM BIODIVERSITY

Main objective and rationale

The main objective of this GAEC is to protect and improve on-farm biodiversity by maintaining non-productive farm features and other areas contributing to biodiversity. Non-productive features include hedges, stone walls, stone-faced banks, earth banks, slate fences, ponds for watering livestock, ditches, field margins, solitary trees, trees in lines or in groups, terraces, etc. Most are used as traditional stock-proof field boundaries and provide valuable shelter for livestock. Many of them represent both cultural and natural heritage, providing ecosystem services and historical and cultural value. Their presence is extremely important for biodiversity of different biota as they provide habitats, feeding, breeding and nesting sites for a variety of wildlife. Landscapes with a high density of traditional, man-made features also obtain a higher aesthetic appreciation. Other areas contributing to the improvement of on-farm biodiversity include catch crops and nitrogen-fixing crops. These have a range of positive impacts on biodiversity, notably on pollinators and birds. Additionally, they also positively impact soil fertility, carbon sequestration and the chemical condition of surface and groundwater.

Hedges enhance species richness and abundance in agricultural fields and are particularly important for bird breeding and rearing.

Relevance for Serbia

This GAEC is highly relevant for Serbia. It will help the country improve its on-farm biodiversity (notably on arable fields) by preserving and better managing non-productive farm features and by expanding the area under catch and nitrogen-fixing crops. Serbia has numerous and diverse non-productive farm features. However, there is hardly any information about their abundance and management on agricultural land. In agriculture-intensive areas, notably in Vojvodina, many non-productive features such as hedges, alley trees, solitary trees and others have been removed to make more space for agricultural production and to enable the more efficient use of agricultural machinery, resulting in huge fields with too few non-crop habitat field margins and poor habitat connectivity. This, as well as the lack of a ban on cutting hedges and trees during the bird breeding and rearing season, have contributed to a decline in the number of insects and meadow birds on agricultural land. At present, catch crops are grown on less than 1 percent of utilized agricultural area. Perennial nitrogen-fixing crops, such as alfalfa and clovers, are not commonly used either, as these are grown on just 5 percent of utilized agricultural area. All GAEC 8 requirements have a positive impact on pollinators, including bees. Farmers producing honey, as well as all other Serbian beekeepers, will largely benefit from the implementation of GAEC 8.

What must the Government do?

The Government must define the minimum share of agricultural area to be devoted to non-productive features, catch crops and nitrogen-fixing crops. Additionally, it must prescribe management practices ensuring the retention of landscape features and protection of bird breeding and rearing in hedges. Optionally, the Government also can include compulsory measures for controlling invasive plant species on agricultural land in this GAEC. If it decides to do so, it must specify the targeted invasive plant species and define the methods for avoiding them.

What must farmers do?

This GAEC stipulates multiple requirements for farmers. They must:

- ✓ Devote a minimum share of agricultural area (most likely 5 percent) to either (i) non-productive features, (ii) catch crops or (iii) nitrogen-fixing crops.
- ✓ Retain landscape features. These do not have to be actively managed, just retained. For instance, hedges do not have to be regularly trimmed; they just must remain on the field.
- ✓ Undertake measures to avoid and eradicate invasive plant species. Unlike the two above, this requirement is optional for the Government. However, if the Government decides to include it in this GAEC, it will be compulsory for farmers.

What must farmers not do?

Farmers are not allowed to:

- ✓ Destroy or damage landscape features (e.g. hedges, ditches, field margins, solitary trees, trees in lines or in groups, terraces, etc.). These do not have to be actively managed[2], just retained. For instance, hedges do not have to be regularly trimmed; they just must stay on the field.
- ✓ Use plant protection products (or, in some cases, manufactured fertilizers) on areas devoted to catch crops or nitrogen-fixing crops.
- ✓ Cut hedges and trees during the bird breeding and rearing season (usually in the period 1 March to 31 August). In some countries, the annual cutting of hedgerows is not allowed. Instead, these must be cut on rotation every second or third year, as most trees and shrubs in hedgerows only produce flowers, nuts and berries on two- or three-year-old growth. Some countries also forbid manures, manufactured fertilizers or pesticides to be applied at the base of the hedgerow, as these will harm the hedgerow and basal hedgerow flora.

Monitoring & inspection

The implementation of most requirements of this GAEC can be monitored through Land Parcel Identification System aerial ortho photos. But this administrative monitoring will, in most cases, be complemented by visual inspections during on-the-spot checks. Inspectors will check whether there is evidence of damage/removal of landscape features and cutting of hedges and/or trees during the bird nesting and breeding season. If this GAEC also requires invasive plant species control, the inspector will check whether appropriate measures have been taken to prevent the encroachment/proliferation of invasive species on the land..

[2] For proactive hedgerow management, farmers can receive extra payments from the agri-environmental measures of the Rural Development Programme.

Nitrogen-fixing crops enhance biodiversity and build soil fertility. From left to right: crimson clover, winged bean and hair vetch.

GOOD AGRICULTURAL AND ENVIRONMENTAL CONDITION 9: BAN ON CONVERTING OR PLOUGHING OF PERMANENT GRASSLAND IN NATURA 2000 SITES

Main objective and rationale

This GAEC seeks to protect environmentally sensitive permanent grassland (ESPG) in Natura 2000 sites, and by doing so to ensure the protection of habitats and species. Natura 2000 is a network of core breeding and nesting sites for rare and threatened species and some rare natural habitat types that are protected in their own right. It stretches across all 27 European Union countries, both on land and at sea. The aim of the network is to ensure the long-term survival of Europe's most valuable and threatened species and habitats, listed under both the Birds Directive and the Habitats Directive.

Relevance for Serbia

Serbia has not yet designated Natura 2000 sites. However, the Serbian Ecological Network is the Serbian equivalent of the Natura 2000 network. It comprises 101 interconnected or spatially close protected areas and ecologically important areas. Many of these are permanent grassland. As already explained under GAEC 1, Serbian grasslands, notably meadows, are in decline, including areas of environmentally sensitive and high-biodiversity-value grassland (for example, 1 000 ha of saline meadows and pastures near Boka, Boćar and Novo Miloševo were recently ploughed up in spite of a warning issued by the authorities). The introduction of this GAEC will improve existing standards for grassland protection and help ensure better enforcement of the aforementioned ban on grassland ploughing. This GAEC is therefore highly relevant for Serbia.

What must the Government do?

The Government is required to designate environmentally sensitive permanent grassland (ESPG) in areas covered by the Birds Directive and the Habitats Directive. Additionally, the Government is required to ensure strict protection of these areas. This includes a ban on ploughing and conversion of permanent grassland to other types of land use – and the proper enforcement of this requirement. Some elements of this kind already exist in the Law on Agricultural Land from 2018. Article 18 of this law prohibits temporary or permanent ploughing of meadows and pastures. However, its enforcement is still a point for improvement.

What must farmers do?

The requirement of this GAEC for farmers is quite simple and straightforward: farmers with agricultural land in ESPG areas must maintain and utilize these areas solely as grassland.

What must farmers not do?

Farmers with agricultural land in ESPG areas are not allowed to plough or in any other manner convert the ESPG to other types of land use, such as arable land, orchards, vineyards, vegetable gardens, etc.

Monitoring & inspection

Whether an environmentally sensitive permanent grassland (ESPG) has been ploughed or in any other manner converted to other land uses can be monitored easily through the data available in the Land Parcel Identification System, based on aerial ortho photos or satellite ortho imagery of agricultural parcels. If needed, this administrative monitoring can be complemented by visual inspections during on-the-spot checks.

A ploughed valuable grassland.

Farmers are not allowed to plough environmentally sensitive permanent grassland in Natura 2000 sites.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