



Landscape features: hedgerows (& results from the SoCo project)

Paolo Prosperi
RWER Unit, JRC Ispra

Preamble of new Regulation for direct support schemes

*“(3)....The **abolition of compulsory set aside** within the single payment scheme **may** in certain cases **have adverse effects for the environment**, in particular **as regards certain landscape features**. It is therefore appropriate to reinforce the existing Community provisions aiming at protecting, where appropriate, specified landscape features.”*

*“(4) Protection and management of water in the context of the agricultural activity has increasingly become a problem in certain areas. It is therefore appropriate to also **reinforce the existing Community framework** for good agricultural and environmental condition **with the aim to protect water against pollution and run-off and to manage the use of water.**”*

health_check_proposal_regul.pdf - Adobe Reader

File Edit View Document Tools Window Help

94 / 161 150% Find

<p>Minimum level of maintenance: Ensure a minimum level of maintenance and avoid the deterioration of habitats</p>	<ul style="list-style-type: none"> – Minimum livestock stocking rates or/and appropriate regimes – Protection of permanent pasture – Retention of landscape features, including, where appropriate, hedges, ponds, ditches trees in line, in group or isolated and field margins, – where appropriate, prohibition of the grubbing up of olive trees – Avoiding the encroachment of unwanted vegetation on agricultural land – Maintenance of olive groves and vines in good vegetative condition
<p>Protection and management of water: Protect water against pollution and run-off, and manage the use of water</p>	<ul style="list-style-type: none"> – Establishment of buffer strips along water courses, – respect of authorisation procedures for using water for irrigation.

Landscape features:
hedges, ponds, ditches,
trees in line, in group or isolated
field margins

8,26 x 11,69 in

Start D:\My Docu... 3 Microsof... health_ch... Document1 ... Inbox - Mic... Search Desktop 13.20

Broadly defined as 'components of the overall landscape used by wildlife & differentiated by vegetative, geologic, hydrologic, and structural elements, which may occur at various scales' (DNR, 2008)

Characterized in relation to their functions (what features, how long, how large, how dense, how many species etc.)....

...or based on their position in relation to other landscape elements (e.g. water courses)

Many MS already include some landscape features preservation in their Agro-Environmental Schemes and/or national legislations (e.g. UK with hedgerows)

Statutory Management Rules provides for safeguarding landscape features of particular importance:

Habitat Directive (Council Directive 92/43/EEC) - Article 10

Member States shall endeavour, where necessary, to encourage the management of features of the landscape which are of major importance for wild fauna and flora. Such features are those which, by virtue of their linear and continuous structure (such as rivers with their banks or the traditional systems for marking field boundaries) or their function as stepping stones (such as ponds or small woods), are essential for the migration, dispersal and genetic exchange of wild species.

Hedge

A boundary, or part of a boundary, which comprises a row of bushes or low trees growing close together, and which have been managed through cutting to maintain a more-or-less dense linear barrier (Barr *et al.*, 1993, Institute of Terrestrial Ecology, ITE)

Hedgerow

A linear feature composed of shrubs and/or trees that forms part of a management unit (Baudry *et al.*, 2000)





Hedgerows generically referred to as “buffer zones”.

However, literature on buffer zones is often ambiguous on which type of hedge it refers to. Most likely grass strips.

Unclear how much of the published information specifically on grass hedges can be directly transferred to hedgerows.

Furthermore, buffer studies conducted at a range of site conditions, plot sizes, rainfall characteristics, soil types and slope angles >> direct comparison is difficult.

No established methods for measuring and monitoring existing buffer features in the field.

(Cranfield University, Defra Project PE0205)

- **Filter strips** (vegetated areas used to trap sediments and pollutants before reaching waterways or sensitive areas, even in urban zones to reduce spreading of traffic-related pollution) (NRCS, 2008);
- **Field borders/hedgerows** (NRCS, 2008);
- **Grassed waterways** (broad, shallow, saucer-shaped vegetated channels designed to move surface water across farmland without causing soil erosion. The herbaceous plants slow down the water flux and protect the channel surface from rill and gully erosion especially when the contributing watershed acreage is relatively large) (Stone, 1997);
- **Field windbreaks/shelterbelts/living snow fences** (rows of trees or shrubs to reduce wind erosion, protect young crops and control blowing of snow and dirt) (NRCS, 2008);
- **Contour grass strips** (narrow bands of perennial vegetation plants on the contour in a crop field, alternated with strips of crops down the slope) (NRCS, 2008);
- **Riparian buffers** and shallow water areas for wildlife (trees, shrubs and grass along waterways) (NRCS, 2008).





Borin et al., 2005; Bradbury and Kirby, 2006:

Grassy buffer strips of at least 5 m width can abate:

- 70–80% of suspended solids;
- 70–98% of P; and
- 70–95% of N

Hansen, 1992

Along water courses, buffer strip of

- **2m width = -90% of sediments**
- **6m = -96% of sediments**

Ma et al., 2002:

- **widening of the buffer affects flora biodiversity more than lengthening**

Probst et al., 2005:

Anti-pollution effect most significantly linked to the width of the buffer zone and the degree of plant interception

Bradbury and Kirby, 2006:

Grassy margins benefit a range of farmland bird species, providing both nesting locations and a source of invertebrates, other than being a key prescription in many UK agri-environment schemes

Some MS already provide for specific recommendations within national legislations

Hedgerows are not autonomous ecosystems (not enough to explain the flora and fauna hosted)

The place of hedgerows in the landscape and their relations with neighboring hedgerows is relevant

Close relationships between hedgerows (field boundaries in general), structure and composition and adjacent land use

The presence of a bank, a ditch or even trimming or chemical weeding operations close to hedgerows influence their fauna and floristic composition

Primary function

- Delimit property boundaries
- Preventing livestock mixing

Products

- Source of wooden material (firewood, timber, etc.)
- Fodder production (e.g. from elm and ash)
- Fruits
- Medicinal plants

Table 1. Hedgerow functions at site and landscape level, and associated hedgerow features and place in the landscape

Level	Physical functions	Biological functions <i>Habitat, corridor, refuge, barrier</i>	Cultural and amenity functions
Hedgerow level	<p><i>Water fluxes:</i> consolidated ditch bordering hedgerow</p> <p><i>Soil conservation:</i> importance of deep-rooted trees and shrubs</p> <p><i>Wind:</i> dense and high tree layer providing a semi-permeable barrier to winds</p>	<p>According to species biological traits and ecological requirements</p> <ul style="list-style-type: none"> • Density of vegetation cover • Complexity of hedgerow structure • Diversity of plant species • Presence of dead trees and rocks • Management techniques and regimes 	<p><i>Age and structure:</i> +earthen or stone bank ditch</p> <p>Management techniques of 'heritage' species e.g. <i>Taxus baccata</i> on religious sites</p>
Landscape level	<p><i>Water fluxes and soil conservation:</i> location of the hedgerow on the slope key points are major limits of soil, mainly at the border of small valleys, and perpendicular to the steep slopes</p> <p><i>Water, soil and wind:</i> connectivity of the hedgerow network ensures continuity and control of fluxes</p>	<ul style="list-style-type: none"> • Relationship with adjacent land use • Isolation of habitat patches and linear features • Connectivity of the networks • Grain size of the landscape 	<ul style="list-style-type: none"> • Historical links e.g. monastic and regionally distinct sites • Adjacency to footpaths and countryside access • Grain size of the landscape

Ryszkowski, 1992

- Hedgerows and shelterbelts root deeper than annual crops & have higher evapotranspiration;
- Intercept lateral water flow nutrients in the subsoil;
- 19-fold decrease in groundwater N concentration found in Poland.

Bazin, 1994

- Hedgerows as windbreak in Denmark = +5% crops yield

Lazzaro et al., 2007

- Single line hedgerow = 82 to 97% spray drift intercepted
- Double row = no significant difference

Follain et al., 2007

- Soil organic C stocks may be significant in the vicinity of hedges compared to landscape average level

Herbst et al., 2006

- Interception storage capacity = 2.6 mm rainfall during the growing season and 1.2 mm in the leafless hedgerows (under canopy area).

Table 1. Hedgerow functions at site and landscape level, and associated hedgerow features and place in the landscape

Level	Physical functions	Biological functions <i>Habitat, corridor, refuge, barrier</i>	Cultural and amenity functions
Hedgerow level	<p><i>Water fluxes:</i> consolidated ditch bordering hedgerow</p> <p><i>Soil conservation:</i> importance of deep-rooted trees and shrubs</p> <p><i>Wind:</i> dense and high tree layer providing a semi-permeable barrier to winds</p>	<p>According to species biological traits and ecological requirements</p> <ul style="list-style-type: none"> • Density of vegetation cover • Complexity of hedgerow structure • Diversity of plant species • Presence of dead trees and rocks • Management techniques and regimes 	<p><i>Age and structure:</i> +earthen or stone bank ditch</p> <p>Management techniques of 'heritage' species e.g. <i>Taxus baccata</i> on religious sites</p>
Landscape level	<p><i>Water fluxes and soil conservation:</i> location of the hedgerow on the slope, key points are major limits of soil, mainly at the border of small valleys, and perpendicular to the steep slopes</p> <p><i>Water, soil and wind:</i> connectivity of the hedgerow network ensures continuity and control of fluxes</p>	<ul style="list-style-type: none"> • Relationship with adjacent land use • Isolation of habitat patches and linear features • Connectivity of the networks • Grain size of the landscape 	<ul style="list-style-type: none"> • Historical links e.g. monastic and regionally distinct sites • Adjacency to footpaths and countryside access • Grain size of the landscape

“The degree to which the landscape facilitates or impedes movement among resource patches” (*Taylor et al., 1993*)

‘Connectivity’ of a landscape depends not only on the distance between habitat patches, but also on the presence of corridors and stepping stones and on the resistance of the surrounding matrix

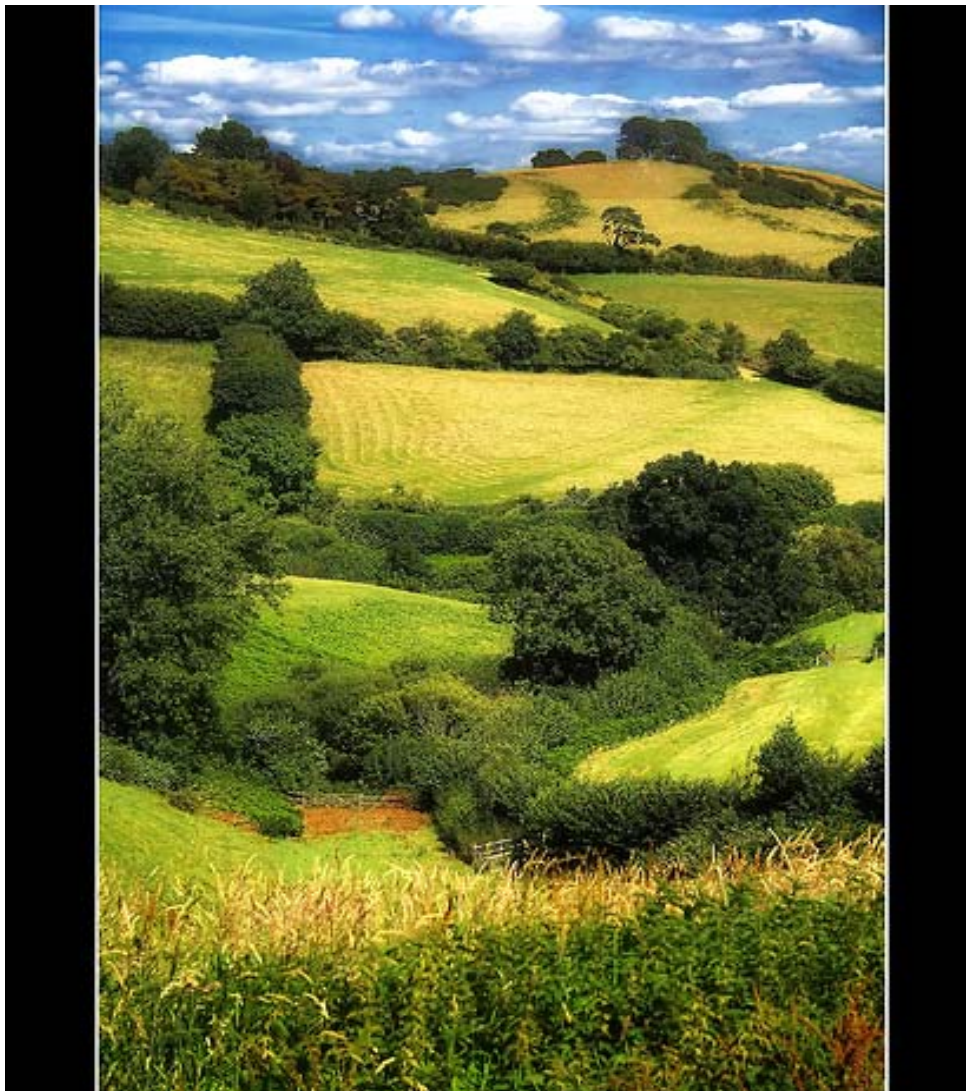
Landscape Structure Model

Landscape element: basic unit of a landscape

Patch: compact element

Corridor: an elongated element

Matrix: the mosaic of the predominating patch type or background cover



International Organization for Biological and Integrated Control of Noxious Animals and Plants (IOBC)

Ecological Infrastructures (EI) are landscape elements managed extensively, such as hedges, semi-natural grassland, high-stem orchards, forest borders as well as wildflower strips, wildflower fallow, grassy beetle banks, field margins, conservation headlands.

The performance of EI depends on their ecological quality, distribution and linkage to other EI outside the farm. Planning their management is one of the key Conservation Biological Control.

The optimum surface of EI to achieve good biological control is estimated to be ~15% of the UAA.

A minimum surface of 5% of farmland is required by IOBC.

Table 1. Hedgerow functions at site and landscape level, and associated hedgerow features and place in the landscape

Level	Physical functions	Biological functions <i>Habitat, corridor, refuge, barrier</i>	Cultural and amenity functions
Hedgerow level	<p><i>Water fluxes:</i> consolidated ditch bordering hedgerow</p> <p><i>Soil conservation:</i> importance of deep-rooted trees and shrubs</p> <p><i>Wind:</i> dense and high tree layer providing a semi-permeable barrier to winds</p>	<p>According to species biological traits and ecological requirements</p> <ul style="list-style-type: none"> • Density of vegetation cover • Complexity of hedgerow structure • Diversity of plant species • Presence of dead trees and rocks • Management techniques and regimes 	<p><i>Age and structure:</i> +earthen or stone bank ditch</p> <p>Management techniques of 'heritage' species e.g. <i>Taxus baccata</i> on religious sites</p>
Landscape level	<p><i>Water fluxes and soil conservation:</i> location of the hedgerow on the slope, key points are major limits of soil, mainly at the border of small valleys, and perpendicular to the steep slopes</p> <p><i>Water, soil and wind:</i> connectivity of the hedgerow network ensures continuity and control of fluxes</p>	<ul style="list-style-type: none"> • Relationship with adjacent land use • Isolation of habitat patches and linear features • Connectivity of the networks • Grain size of the landscape 	<ul style="list-style-type: none"> • Historical links e.g. monastic and regionally distinct sites • Adjacency to footpaths and countryside access • Grain size of the landscape



Results from the SoCo project



Underlying problem : 150 million ha of agricultural land in Europe suffer from soil degradation



Poor drainage



Erosion



Loss of organic matter



Salinization

....but also compaction, contamination, loss of biodiversity, landslides

SoCo has been designed to study and promote sustainable agriculture and to improve the understanding of soil conservation practices in agriculture



*Project initiated by European Parliament
(Stéphane Le Foll)*



Mariann Fischer Boel
EU agriculture commissioner

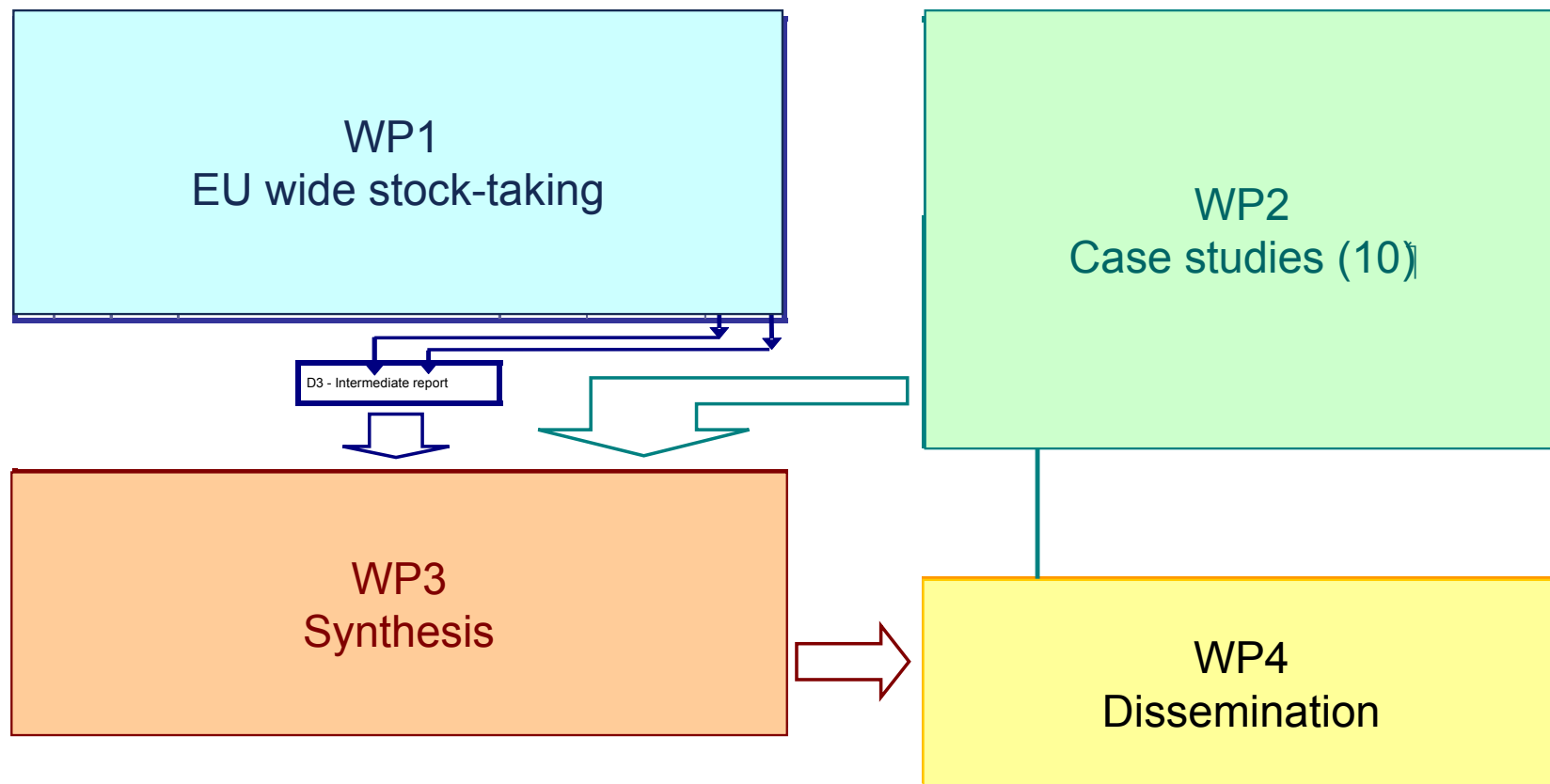
Assigned to EU Commission (DG AGRI)
and in turn to JRC-IPTS, Seville

Coverage: EU 27
10 country-specific case studies

(Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Greece, Italy, Spain, UK)



Scheme of work flow within the SoCo project



Project timeframe : WP1-WP3 end in 2008. WP4 early 2009

WP1 identified 10 technical measures & 2 farming systems for soil conservation

Technical measures (agronomic)

- Ridge tillage / Intercropping / Subsoiling / Cover crops / Rotation
- Agroforestry / Contour farming / Buffers / Terracing / Grasslands

Farming systems

Conservation Agriculture

- No-tillage (+ crop rotation + cover crops)
- Reduced tillage (+ crop rotation + cover crops)

Organic farming

Environmental and economic performance assessed

Ridge tillage



Intercropping



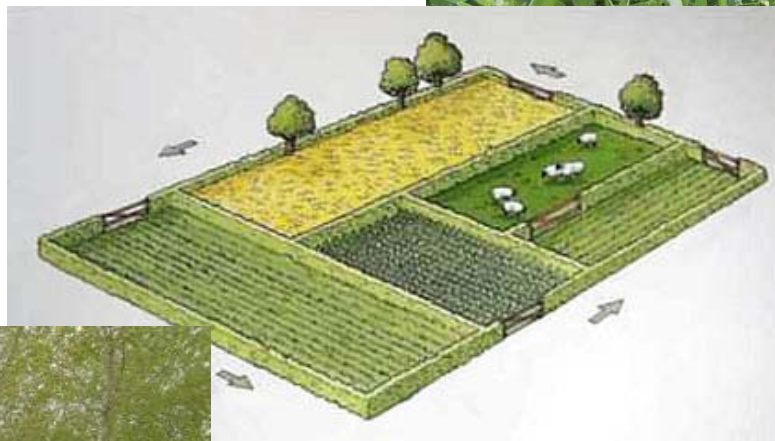
Subsoiling



Cover crop



Crop rotation



Agroforestry



*Contour
farming*



Terracing



Permanent
grasslands



Buffer strips

Main results:

Practices to both reduce or to avoid soil degradation effects do exist, but application must be carefully selected at local scale

Buffers regarded as a useful a posteriori remedy to erosion, pollution and to increase biodiversity and improve landscape

Conservation Agriculture found as most promising preventing practice wrt soil degradation

Current policy setting (GAEC+SMR+RDP) useful but not always sufficient in reversing the soil degradation trend

Conservation Agriculture

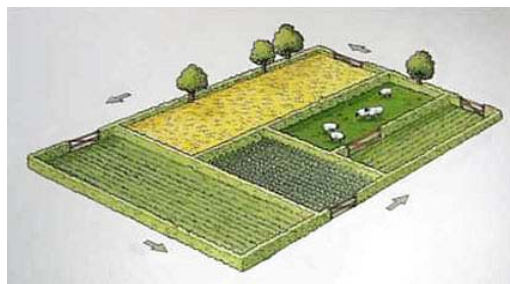
No-till



Reduced tillage



+
Crop rotation



+
Cover crop



SoCo French case study:

**hill-side wide intensive cropping with absence of hedgerows
or other landscape features = erosion, run-off, pollution**





Thank you

Paolo Prosperi
RWER Unit, JRC Ispra